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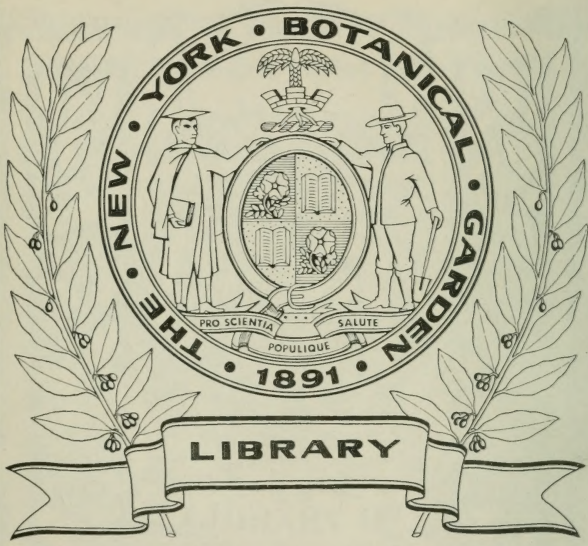

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THE

BOTANY OF BIHAR AND ORISSA

An Account of all the Known Indigenous Plants of the Province and of the Most Important or Most Commonly Cultivated Exotic Ones

By

H. H. HAINES, C.I.E., F.C.H., F.L.S.

Late Conservator of Forests, Bihar and Orissa

Published under the Authority of the Government of Bihar and Orissa

PART IV

GAMOPETALÆ

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AN ACCOUNT OF ALL THE KNOWN INDIGENOUS PLANTS OF THE PROVINCE AND OF THE MOST IMPORTANT OR MOST COMMONLY CULTIVATED EXOTIC ONES

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NEW YORK BOTANICAL GARDEN

DIVISION II.—GAMOPETALÆ.

FAM. 77. RUBIACEÆ.

Trees, shrubs or herbs, rarely scandent, sometimes thorny, with simple entire opposite or whorled leaves, often with gland-pits in the axils of the secondary nerves, and with inter-petiolar or intra-petiolar usually connate stipules, or leaves whorled without stipules. Flowers small or minute to very large, solitary or in variously formed inflorescences. Ovary inferior closely invested by the hypanthium, which usually bears a toothed or lobed calyx. Corolla gamopetalous, regular, 4–5-merous or rarely lobes up to 12, æstivation various. Stamens usually as many as the petals, sometimes fewer where the petals are more than 5, inserted in the tube or mouth of the corolla, anthers 2-celled, usually dorsifixed, sometimes sessile. Disc epigynous, usually annular or swollen. Ovary usually 2-celled, very rarely 1-celled (*Gardenia*), rarely 3–9-celled. Style simple or cleft. Ovules 1 or more in each cell, usually attached to the septum; on parietal placentæ in *Gardenia*. Fruit various. Seeds with fleshy or horny albumen. Embryo straight or curved, cotyledons usually flat, sometimes semi-terete, radicle superior or inferior.

The germination in those species examined by me is epigeal and the cotyledons are foliaceous and grow considerably. It is noteworthy that interpetiolar stipules are present in the cotyledons in *Ixora*, *Gardenia* and perhaps others.

* Trees or shrubs. (Undershrubs in some, 6, 20 and 21.):-

I. Flowers collected into dense heads on a globose or somewhat oblong receptacle. Seeds often winged.

A. Ovules numerous in each cell.

1. Hypanthia confluent or connate. Cor.-lobes imbricate . . . . . 1. *Anthocephalus.*

2. Hypanthia not connate.

a. Cor.-lobes valvate. Receptacle bracteolate.

Sepals distinct . . . . . 2. *Adina.*

Sepals 0 . . . . . 3. *Mitragyna.*

b. Cor.-lobes imbricate. Receptacle ebracteolate 4. *Nauclea.*

B. Ovule 1 in each cell. Hypanthia sometimes confluent. Fruit of free or connate drupels with 4 pyrenes . 5. *Morinda.*

II. Flowers not collected into heads on a globose receptacle (but cymes sometimes capitate).

A. Ovules more than 1 in each cell.

1. Corolla-lobes valvate.

a. Fruit baccate. Flowers in terminal corymbose panicles. One calyx-lobe usually white and foliaceous . . . . . 6. *Mussænda.*

b. Fruit capsular. Flowers in thyrsiform panicles with two foliaceous bracts. Seeds winged . 7. *Hymenodictyon.*

2. Corolla-lobes twisted in bud.

a. Fruit capsular small. Fls. small panicled . 8. *Wendlandia.*

b. Fruit indehiscent. Fls. large or m.s. (exc. *Hyptianthera*).

i. Fls. small clustered axillary . . . . 9. *Hyptianthera.*

ii. Fls. large or m.s.

† Bracteoles connate into a calyculus. Fls. in axillary small cymes or fascicles . 10. *Diplospora.*

†† Bracteoles not connate into a calyculus. Stigma fusiform.

! Unarmed. Fls. in terminal corymbs . 11. *Webera.*

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!! Sometimes armed. Fls. solitary, fascicled or in small cymes.
Ovary 1-celled, placentæ 2–5 . . . 12. *Gardenia.*
Ovary 2-celled . . . . . 13. *Randia.*
B. Ovules solitary in each cell.
1. Fruit baccate or drupaceous.
a. Corolla lobes twisted in bud.
i. Flowers in terminal corymbose panicles.
Style not twice as long as tube. . . . 14. *Ixora.*
Style twice as long as tube . . . . 15. *Pavetta.*
ii. Fls. 1-3 sessile terminal, or fls. in axillary fascicles . . . . . 16. *Coffea.*
b. Corolla lobes valvate. Stamens inserted near cor.-mouth. Fruit with 2–many pyrenes.
i. Flowers in axillary cymes or fascicles. Often thorny.
Ovary 2-celled . . . . . 17. *Canthium.*
Ovary 3-5-celled. Calyx 5-toothed . . 18. *Vangueria.*
Ovary 3-9-celled. Calyx 3-6-fid. Style-arms 3-9 . . . . . 19. *Lasianthus.*
ii. Flowers in terminal cymes. Unarmed under-shrubs.
Corolla straight . . . . . 20. *Psychotria.*
Corolla curved . . . . . 21. *Chasalia.*
2. Fruit capsular. Shrubs fœtid when bruised.
Erect. Style 5-fid. . . . . 22. *Hamiltoniana.*
Twining. Styles 2 . . . . . 23. *Pæderia.*
** Herbs (climbing shrub in *Hedyotis scandens*). Corolla valvate in bud:—
I. Ovules many in each cell.
A. Petals toothed. Fruit indehiscent. Prostrate herb 24. *Dentella.*
B. Petals not toothed. Fruit usually dehiscent or of cocci.
1. Flowers secund on the cyme branches.
Sub-succulent herbs. Capsules compressed . . 25. *Ophiorrhiza.*
2. Flowers clustered or in cymose panicles, not secund.
Seeds angled or plano-convex. Sepals contiguous 26. *Hedyotis.*
Seeds angled or globose. Sepals remote . . 27. *Oldenlandia.*
Seeds peltate boat-shaped, coarsely pitted. Sep. remote . . . . . 28. *Anotis.*
II. Ovules solitary in each cell.
A. Leaves not whorled (sometimes apparently whorled from the congested axillary shoots). Fruit dehiscent or of 2 cocci.
1. Flowers axillary, clustered.
Not fleshy. Fruit capsular or of 2 cocci . . 29. *Spermacoce.*
Fleshy. Fruit corky, compressed and keeled . 30. *Hydrophylax.*
2. Fls. subspicate on the branches of terminal cymes 31. *Knoxia.*
B. Leaves whorled, exstipulate.
Fls. minute in axillary and terminal cymes. Carpels indehiscent . . . . . 32. *Rubia.*

1. ANTHOCEPHALUS, *A. Rich.*

Tree with large leaves and narrow lanceolate caducous stipules enclosing the narrow-lanc. bud. Flowers small in dense terminal solitary globose heads without bracteoles and with more or less connate hypanthia. Calyx-limb with 5 well-developed lobes. Corolla-tube long, funnel-shaped, lobes imbricate. Stamens on the throat with short filaments. Epigynous disc of 5 fleshy lobes. Ovary 4-celled above, 2-celled below, placentæ twice bifid. Style exserted, stigma prominent narrowly clavate. Ovules very many. Each fruit

consists of a thin epicarp and 4 horny or coriaceous cocci above which are easily separable from the fragile lower part and contain most of the numerous angular punctulate seeds (the *F.B.I.* says seeds few, but I have counted over 50 from one fruit), common receptacle globose fleshy in fruit. Seeds minute, embryo clavate in fleshy albumen.

1. **A. cadamba,** *Miq.* Syn. Nauclea cadamba, *Roxb.*; Kadam, *H., S.*; Sanko, *K.*

A large and, in the forest, very straight tree with spreading subwhorled branches and large ell.-oblong or ovate, sometimes subcordate-based leaves 5–10″ long. Flowers small orange-coloured with erect narrowly oblanceolate sepals ·12″ long, corolla ·3″ long, and far exserted white stigmas. Pseudocarp large, fleshy, orange, 2–2·5″ diam.

Wild along the northern frontier! Also wild in hill valleys of the Central and Southern areas in Singbhum! Athmallik! and some of the Orissa States, Kharsawan, Gangpur, Bonai and Pallahara, *teste Cooper*. Very often planted, but in dry localities stunted. Fl. May–July. Fr. Aug.–Oct. Evergreen in its natural home, often deciduous when planted.

Attains 6–8 ft. girth with smooth brown bark and thick yellow-brown blaze, white on the wood. Leaves glabrous or (*teste Brandis*) pubescent beneath, acute or shortly acuminate, sometimes suddenly cuneate on the petiole, sec. n. 8–15 strong slightly curved. Petiole 1–2″. Stipules ·5–·6″. Ped. stout ·5–1″.

A very fast-growing tree when young and in favourable localities (with plenty of water) attaining 10–15 ft. in two years. The wood is used for planking and boxes. *Gamble* gives weight as 40 lbs. The fruit is eaten. The seed requires a perfectly clean seed-bed or the seedlings quickly die.

2. ADINA, *Salisb.*

Trees or shrubs with large broad stipules enclosing the terminal bud and caducous on its expansion. Flowers small in dense heads on a globose hairy receptacle with or without bracteoles, hypanthia not connate, angled, sepals 5 narrow. Corolla funnel-shaped or tubular with an urceolate upper part, 5-lobed. St. in the throat of the corolla, fil. short. Ovary 2-celled, style filiform, stigma capitate or shortly clavate. Fruit a small capsule of 2 cocci dehiscent from below and towards a persistent columella, with many oblong winged seeds.

1. **A. cordifolia,** *Hook. f.* Kumba, Kurumba, *K.*; Karam, *H., S.*: Halanda, *Or.*; Mundi, *Or.* (*teste Grieve*).

A large tree with broad crown, broadly ovate or orbicular cordate leaves 4–8″ long and broad and sub-orbicular stipules enclosing the terminal bud. Heads ·75–1″ diam. yellow axillary usually in vertical rows of three. Fruiting heads dry ·4–·5″ diam.

Throughout the whole area. Attains large size in the Sameshwar hills, in parts of Singbhum and in the Angul forests! Fl. June–July. Fr. Feb.–May. Deciduous Feb.–May.

Often 7–8 ft. girth with a straight clean bole. Bark smooth light coloured exfoliating in patches, blaze pink with an inner white border and yellow on the wood. Leaves pubescent beneath, shortly abruptly acuminate, with 5–8 sec. n. of which 1–2 are close to the base. Petiole 2–3″ tomentose or glabrescent. Peduncles 1–3″ with two small caducous bracts towards the ends. Bracteoles filiform hairy

and somewhat expanded upwards. Buds silky-pubescent. Sep. linear. Corolla ·25″, tube pubescent.

The timber is a good deal used both for building and for planking. It has also been used for light railway sleepers. Planks are apt to split badly when dry. It is also used for the backs of brushes and other small articles and takes a good polish. *Gamble* gives the weight as 45 lbs. The value of 'P' appears very variable (from 464 to 760). On a clean seed bed it is not difficult to grow; plants raised by me in Chaibassa attained 38 ft. high and 28·75″ girth in 16 years.

3. MITRAGYNA, *Korth.* (Stephegyne, *Korth.*).

Trees or shrubs with stipules as in *Adina*. Fls. much as in *Adina* each surrounded by palæaceous bracteoles, but calyx truncate entire or with 5 only small teeth. Corolla tubular-funnel-shaped with 5 valvate lobes. Stigma capitate or mitriform. Fruit and seeds as in *Adina*, from which it appears to me to be rather artificially separated.

1. **M. parvifolia,** *Korth.* Syn. Stephegyne parvifolia, *Korth.*; Karam, Kaim, Kalmi, *H.*; Sande-kuma, *Ho.*; Guni, Amsabita, *Mund.*; Guri, *Kharw.*; Gore, *S.*; Gulikadam, keli-kudur, Mitkunia, *Beng.*; Mur, Mundi, *Or.*; Tikuk, *Th.*

A mod.-sized tree with silver-grey twigs, broadly ell. obtuse leaves 4–6″ by 3–4″ and oblong keeled stipules covering the buds and falling on their expansion. Heads of flowers 1″ diam., 1–3-together on a short lateral axillary branch or peduncle bearing two pale-coloured leaves or bracts near the summit; these persist more or less in fruit. Flowers narrowly funnel-shaped. Bracteoles clavate. Fruiting heads ·5–·6″, capsules ellipsoid verrucose.

Throughout the area, fairly common. More in the plains and valleys than *Adina*. Fl. May-June. Fr. following March and April but ripe seed also collected in Nov. Deciduous May.

Bark and blaze much as in *Adina cordifolia*. Leaves glabrous except near the axils of the 7–10 prominent sec. n., base rounded or cuneate, not cordate, sometimes obovate with rounded shortly cuspidate apex. Petiole ·5–1·5″. The flower heads are terminal on the short lateral branchlets and the secondary peduncles arise in the axils of the bract-leaves and overtop the older head forming a cyme. lateral peduncles 1–2″ long.

The wood is said not to be as good as that of *Adina cordifolia*. The branches are often lopped for fodder. It coppices from the cambium and should therefore be cut low. Trees grown by me in Singbhum were 33 ft. high with a girth of 30·4″ after 16 years.

4. NAUCLEA, *L.*

Trees or shrubs with large leaves and broad stipules sheathing the terminal bud. Flowers in globose heads as in *Adina* with or without bracteoles. Hypanthium turbinate or obconic free. Calyx lobes 5 usually tipped with valvate processes. Corolla tubular-funnel-shaped with short imbricate lobes. Fruit of 2 dehiscent many-seeded cocci. Seeds winged. Embryo clavate.

Glandular-pits in the nerve axils are frequent in *Adina, Stephegyne* and in *Nauclea*, obscure in *Sarcocephalus*, absent in *Anthocephalus* and *Cephalanthus*.

1. **N. purpurea,** *Roxb.*

A small tree with pale glabrous twigs and large oblong stipules ·5–·6″ long. Leaves 5–10″ by 2·5–4·75″ elliptic-lanceolate or -oblanceolate acute or subacute quite glabrous, shining above, base

narrowed into the petiole rather slender ·75–1·75″ long petiole. Sec. n. 7–8 prominent beneath with glandular pits in the axils of some, other nerves obscure.

Ravines in the Santal Parganas, very rare!

Bark smooth, blaze light yellow turning brown. *N. purpurea* has not hitherto been found north of the Circars and as flowers have not been collected from our tree there must be a little doubt of its identity. The floral characters of *N. purpurea* drawn from other specimens are: Heads 1·5″ diam. terminal 1–3 together on peduncles 2–3″ long which are bracteate near the middle, bracteoles conical bristle-like. calyx silky, lobes purple. corolla glabrous. Fruit crowned with the persistent base of the calyx-lobes.

5. MORINDA, *L.*

Trees or shrubs with connate sheathing stipules. Flowers white more or less connate by their hypanthia into peduncled heads. Calyx short or 0. Corolla with short or long tube and 4–7 coriaceous valvate petals. Stamens 4–7, filaments short. Ovary 2–celled or each cell again divided by a false septum, style slender, 2-branched. Ovules 1 in each cell ascending from near the base of the true septum. Fruits forming a pseudocarp with the succulent enlarged hypanthia enclosing many 1-seeded pyrenes or those of each fruit sometimes cohering in a 2–4-celled putamen, or drupels nearly free. Seeds obovoid or reniform, testa membranous. Embryo terete, radicle inferior.

Leaves ovate, obovate or elliptic. Syncarp globose.
Leaves usually very broad, glabrous or nearly so . . . . 1. *tinctoria*.
Leaves sometimes narrow, pubescent or tomentose . . . var. *tomentosa*.
Leaves elliptic-lanceolate. Fruits free, fruiting heads elongating, oblong . . . . . 2. *angustifolia*.

1. **M. tinctoria,** *Roxb.* Chaili, *K., S.*; Sali, *M.*; Al, Ach, *H.*; Achu, *Or.*

A small tree 15–25 ft. high with large ovate obovate or elliptic leaves or the upper ones near the inflorescence oblanceolate, usually shortly suddenly acuminate and base suddenly narrowed into a 1″ long petiole. Fls. white ·75–1″ diam. in solitary or 2-nate leaf-opposed or terminal peduncled heads with the hypanthia more or less connate. Pseudocarp 1″ diam. whitish-green, with the boundaries of the separate fruits marked by lines or sometimes the tops of these separate.

Central and Southern areas. Fl. May–Sept. Fr. Jan.–Feb.

Attains 3 ft. girth with brown or grey corky bark and grey-brown blaze. Twigs square or oblong in section, usually reddish brown in the type. Petiole ·5–1·5″. Stipules ovate acute or acuminate, sometimes accrescent and foliaceous. Heads solitary, axillary or two in a terminal cyme, only ·25″ diam. without the corollas. Anthers included ·2″. Ovary 2-celled.

The following varieties may be distinct species:

Var. 1, **tinctoria** *proper.*

Shoots glabrous. Leaves usually very broad 6–11″ by 4–6″, glabrous except in the nerve axils, base unequal or cuneate on the petiole, sec. n. 7–9. Heads glabrous or buds puberulous. Corolla-tube ·5–·6″, petals oblong ·35″, filaments ·12″, top of ovaries free in flower and drupels prominent in fruit, style-arms glabrous narrowly lanceolate.

Central area, common near villages, perhaps wild in Santal P.! Wild in Southern area and common on the Durgapur sandstones in Angul!

Var. 2, **tomentosa**, *JDH.* Syn. M. tomentosa, *Heyne.*

Shoots densely pubescent. Leaves usually elliptic 5–9″ by 3–5″, pubescent both sides especially beneath, base tapering, sec. n. 5–10. Heads very pubescent. Cor.-tube ·8″, petals ·4″, anthers subsessile, top of ovary and drupels connate, style arms filamentous pubescent.

It is not known whether these floral characters are constant. If they are the variety should be ranked as a separate species.

Singbhum, in valleys! Angul! Sambalpur!

The root-bark is collected for dyeing from both varieties.

2. **M. angustifolia,** *Roxb.*

A small tree, or flowering as a large shrub, with long narrowly elliptic-lanceolate or oblanceolate leaves 6–12″ long acuminate or sub-acuminate and tapering at the base into a petiole ·3–1″ long. Flowers white with a corolla tube ·5–·6″ long in globose heads which gradually elongate and in fruit are oblong. Fruits free, obovoid-globose, nearly white, ·3–·4″ diam.

Jungles of N. Purneah! Fl., Fr. Oct.–Jan.

Bark of twigs pale brown. L. nearly glabrous but minutely puberulous beneath on nerves, sec. n. 13–18, curved near the margin, tertiaries oblique distinct. Stipules short and broad or narrowly ovate. Peduncles ·3–1·5″. Calyx truncate or with most minute teeth. Corolla salver-shaped, throat naked, petals ·4″ long lanceolate. Drupes 4-celled. Pyrenes 1–4 pyriform compressed, each containing a peripheral flattened seed and an inner hollow chamber.

The root bark is said to be used for dyeing like that of the other species. The structure of the pyrenes is remarkable and they at first look to be deformed by insect puncture but this is not so.

6. MUSSÆNDA, *L.*

Shrubs or undershrubs, sometimes scandent with opposite or 3-nately whorled leaves with strong sec. n. and free or connate interpetiolar, sometimes caducous stipules. Flowers usually yellow in terminal cymes frequently very conspicuous from one of the sepals being developed as a large white or coloured leaf. Hypanthium oblong, turbinate or globose, sepals with the exception of the foliaceous one often deciduous. Corolla tubular below, funnel-shaped above, throat villous, lobes 5 valvate with everted margins in bud. Stamens in the tube or throat, fil. very short, anthers linear. Ovary 2-celled, stigmas linear. Ovules many on peltate fleshy placentæ. Fruit baccate, areolate at the top. Seeds many minute, pitted. Embryo minute in dense fleshy albumen.

Undershrub, tomentose or villous	1. *incana.*
Shrubs. Cultivated in our area.	
Foliaceous sepal large white 3–4″ long.	
Sepals persistent in fruit. Erect	2. ***Roxburghii.***
Sepals deciduous, more or less scandent	3. *macrophylla.*
Foliaceous sepal only 1–2″, yellow	4. *luteola.*

1. **M. incana,** *Wall.*

An undershrub 1–3 ft. densely clothed with appressed hairs, with ell., ovate, or oblong hairy sub-sessile leaves 4·5 by 2·5″ and sub-sessile corymbose cymes 1–1·5″ diam. of chrome-yellow flowers with the foliaceous sepal 3″ including the stalk cream or pale-lemon coloured. Berry ·4–·5″ long with adpressed hairs.

Forests on the Porahat plateau, Singbhum, rare! I have also found it in Bengal bordering on Purneah where it is likely to occur. Fl. July–Aug. Fr. Sept.–Oct.

Leaves pale beneath, sometimes 5–6″ sometimes only 2″, usually acute or subacute with 9-10 strong sec. n. sunk above. Corolla ·75″ long. Fruit with small areole, somewhat depressed-globose.

2. **M. Roxburghii,** *Hook, f.*

A large shrub with elliptic acuminate or caudate leaves narrowed at the base, 3–8″ long, strigose on mid-rib beneath and sparsely so between the nerves, sparsely setulose above, sec. n. 8–10, petiole very short, stout. Corymbs dense, 2″ diam. Corolla-tube very strigose, ·7–·8″ long, limb ·3″ diam. Petaloid sepal 2–3″ including the slender stalk. Fruit broadly ellipsoid areolate above with setaceous sepals ·2–·3″ long.

Cultivated in gardens. Fl. June–Nov. Native of Assam.

3. **M. macrophylla,** *Wall.*

A more or less scandent shrub with much more broadly elliptic cuspidate leaves about 5 by 3″, suddenly cuneate on the short petiole, sec. n. 8–10. Hairs much more lax especially on the cyme. Corolla ·4–·6″ diam. Fruit with lax hairs, sepals deciduous.

Cultivated in gardens.

M. frondosa, *L.*, is distinguished chiefly by the narrowly lanceolate acute sepals as compared with the oblanceolate obtuse sepals of *M. macrophylla*.

4. **M. luteola,** *Delile*, is an African species with ovate-lanceolate leaves 1·5–2·5″ long only. Foliaceous sepal pale yellow. It is a pretty bushy shrub.

7. HYMENODICTYON, *Wall.*

Trees or shrubs with bitter bark and deciduous stipules not enclosing a prominent compressed terminal bud as in the preceding genera. Leaves large. Flowers small racemed or spicate on the short branches of axillary and terminal nodding panicles which have usually a pair of foliaceous persistent bracts on the rhachis or peduncle. Hypanthium sub-globose, sepals 5–6 very small. Corolla tubular and slender below, ventricose above (funnel or bell-shaped, *F.B.I.*), glabrous within, lobes 5 short valvate. St. with short filaments inserted at the top of the tube, anthers linear. Ovary 2-celled, style filiform, stigma capitate or spindle-shaped. Fruit a loculicidal 2-valved capsule. Seeds many imbricate, testa broadly winged. Embryo small.

1. **H. excelsum,** *Wall.*

A large or m.s. tree with leaves at the ends of the branches ovate to very broadly elliptic 4–10″ by 3–6″. Flowers greenish, crowded on the abbreviated branches of thyrsoid sub-erect or drooping tomentose panicles 3–6″ long (or more if the axillary panicles are included) which are subtended by long-petioled leaf-like bracts which become dry in fruit. Capsules ·7–·75″ long ovoid or ellipsoid, finally reflexed (or on reflexed rhachis).

In all the hill districts and also in Purneah! Usually in dry rocky situations, especially near rocky nalas. Fl. Aug. Fr. ripens Jan. Leafless from Nov.–May, when it may be easily recognised by the characteristic pyramidal panicles of reflexed capsules and the pair of dry foliaceous bracts.

Bark dark-grey thick rugged, blaze soft pale pink streaked white, or nearly white streaked brownish-red or yellow. Leaves softly pubescent, shortly suddenly acuminate, base acute, sec. n. 7–10, tertiaries very fine. Stipules ·25″. Petiole 1–4″ long. Pubescent hypanth. with calyx ·07″, corolla ·25–·3″

The wood yields good planks which take a good polish and do not warp. The tree coppices freely from the collar and also from the cambium. The seed requires a clean bed and in nature often germinates in a rock crevice. The inner bark and root are given in fever by the Kols and Santals.

8. WENDLANDIA, *Bartl.*

Small trees or shrubs with well-developed often persistent stipules. Fls. small white 2–3-bracteolate in terminal dense panicled cymes. Hypanth. small globose with 4–5 small persistent sepals. Corolla with a long or short tube and 4–5 lobes imbricate in bud, throat glabrous or hairy. St. with versatile exserted anthers. Ovules on two small globose axile placentæ. Capsule small globose splitting loculicidally through the top, 2-valved with minute compressed seeds.

Stipules recurved. Corolla lobes longer than the tube . . . . 1. *exserta*.
Stipules erect. Corolla lobes much shorter than the tube . . . 2. *tinctoria*.

1. **W. exserta,** *DC.* Syn. Rondoletia exserta, *Roxb.*; Tilia, *H.*; Tilai, *K.*; Hundru, *S.*; Tiruwa, *Mal. P.*

A handsome small tree, hoary or pubescent all over, with oblong- or ovato-lanceolate acuminate leaves 4–8″ by 1–2·5″ and persistent or sub-persistent broadly-oblong or ovate recurved stipules. Flowers very fragrant about ·08″ long with the reflexed petals ·1″ long. Capsule hoary pubescent ·06–·07″ diam. crowned by the erect lanceolate hairy sepals.

In all districts except, perhaps, Balasore and Cuttack! Rather local but some times sub-gregarious in second-growth forest and on broken ground. Fl. March–April. Fr. April–May. Evergreen.

Rarely attains 2·5 ft. girth with light brown bark. Easily recognised by its grey foliage. Leaves with 12–16 prominent sec. n., tertiaries short often indistinct, base acute, petiole ·5–·8″. Panicles pyramidal 3–6″, lower branches sometimes axillary. Branches with rhomboid-lanc. hairy bracts ·15–·2″ long each subtending a subsessile cyme of about 3 flowers. Corolla tube broad, nerved.

Sometimes used for house posts. It is a very light-demanding tree which, like so many *Rubiaceæ*, appears only to germinate or the seedlings only to survive on ground quite free from weeds, and hence often comes up on landslips, abandoned jhumed areas, etc., and is useful for clothing such places.

2. **W. tinctoria,** *DC.* Hundru, Undru, *K.*; Tilai, *S.*; Tile, *Khond.*

A small tree or large shrub, densely branched, not hoary, with nearly glabrous elliptic, oblong or obovate leaves 4–8″ by 2–3·5″, acute or obtuse narrowed into the ·5–·75″ long petiole. Stipules ·25–·4″ erect orbicular or ovate with a long laterally compressed cusp. Corolla ·2–·75″ long with the lobes much shorter. Capsule ·06–·07″ diam. pubescent, reddish.

Chiefly in Sal forest and distinctly a shade-bearer. Throughout the province but especially in the Central Area in valley forests! Fl. Jan.–March. Fr. March–April. Evergreen, renews leaves March–April.

Bark brown stringy, blaze light rose-coloured, white on the wood. Shoots pubescent. Leaves shining above, pubescent on the 8–12 sec. n. beneath and when young, often with a short obtuse apex. Panicles 6–8″ or sometimes 10″ pubescent pyramidal, bracts subulate, fls. sessile. The flowers open before the corolla-tube lengthens.

The bark is used as a mordant in dyeing.

9. HYPTIANTHERA, *W. & A.*

A glabrous shrub with short-petioled leaves and white flowers sessile in axillary fascicles. Hypanthium shortly tubular slightly dilated upwards, calyx-tube above the ovary very short with 5 sepals. Corolla very shortly tubular with 4–5 erect or spreading twisted lobes, very caducous, hairy within. Anthers 4–5, sessile, oblong,

hairy, inserted by their backs to the tube and nearly included. Disc a pulvinate ring. Ovary 2-celled with very short stout villous style and 2-cleft stigma. Ovules 4–10 in each cell on a pendulous placenta. Fruit baccate small. Seeds 4–5 in each cell, angled, with a characteristic fibrous testa.

1. **H. stricta,** *W. & A.*

A shrub or small tree attaining 20 ft. with sharply 4-angled or compressed horizontal decussate branches and spreading lanceolate, oblong or linear-oblong acuminate glabrous often undulate leaves 3–6″ by ·75–1·5″ glossy both sides. Flowers small white sessile with a corolla only ·1–·17″ long with broadly ovate lobes. Berries globose-oblong ·25–·3″ diam. crowned by the persistent calyx.

Not common. Purneah and North Champaran, attaining 20 ft. near streams! Cool valleys in Singbhum! Ravines in the Santal P.! Mayurbhanj, near streams in the mountains! Fl. April–May. Fr. Feb.–March. Evergreen.

When arboreous trunk slender with slightly grooved bark. Leaves slightly pubescent on nerves beneath when young, often caudate, base rounded or cuneate, sec. n. 5–7 slender, other nerves obscure. Petiole ·25–·5″. Stipules acuminate persistent hairy. Bracts lanceolate hairy ·08″, bracteoles much smaller. Calyx with hypanthium ·1″ long with narrow-lanceolate teeth. Corolla-tube shorter than calyx, hairy behind the anthers. Flesh of berry very viscous.

10. DIPLOSPORA, *DC.*

Trees or shrubs with short-petioled distichous leaves. Flowers in fascicles or short cymes axillary or from leafless axils, white or greenish, sometimes polygamo-dioecious, bracts free or (in our species) connate in a cup. Hypanthium short, calyx 4–5-lobed or truncate. Corolla-tube short, petals 4–5 spreading, twisted in bud. Stamens on the mouth of the tube, anthers exserted oblong or linear. Ovary 2-celled. Disc sometimes large swollen. Ovary 2-celled, style with 2 linear or oblong stigmas (or branches). Ovules 2–7 in each cell, on the septum. Fruit baccate with 3–7 2-seriate imbricate seeds in each cell.

1. **D. singularis,** *Korth.*

A straight glabrous tree attaining 3 ft. girth with pale brown compressed twigs, bifarious oblong or ell.-oblong acuminate or caudate leaves 4–6·5″ shining both sides with petiole ·3–·6″. Flowers subsessile in very short-peduncled capitate cymes mostly from the leaf-scars, involucrate with 4-connate bracts and the base of the short peduncle also sheathed by a smaller whorl. Corolla green salver-shaped with scarcely exserted tube, petals ·3″ oblong acute soon spirally twisted. Fruit on short woody bracteate peduncles ·7–·8″ diam. globose areolate at top. Seeds 4–7 in each cell flattened oblong, ·25″ long.

Evergreen jungles, Mals of Puri! Fl. April–May. Fr. Dec.–Feb.

Bark smooth, somewhat striate, grey. Blaze pale brown, then yellowish or flesh-coloured, darkening on exposure. L. paler beneath, base acute or cuneate, sec. n. 3-6 slender, their axils often gland-pitted and hairy round the gland. Stipules triangular with a long acuminate tip. Cyme of about 4 groups of 3 fls. and a terminal one. Calyx tubular-campanulate ·12″, tube sometimes 2-cleft; lobes 4, half as long as persistent tube, broad. Upper part of corolla-tube and base of petals villous. Fil. short, anthers erect linear.

Distrib.: Chittagong, Burma and Malay Peninsula to Borneo.

11. WEBERA, *Schreb.*

Trees or shrubs. Flowers 5- rarely 4-merous in terminal corymbiform cymes, bracteolate. Hypanthium ovoid or turbinate. Corolla funnel- or salver-shaped, throat glabrous or pubescent, lobes twisted in bud. Stamens on the throat or mouth, fil. short or 0 with slender exserted anthers. Ovary 2-celled with stout short pubescent styles and stout fusiform grooved stigma. Ovules numerous, rarely few (or 2 or 1 in species outside our area) in each cell, often immersed in the fleshy peltate placentæ. Berry small globose. Seeds plano-convex or almost cupular or shaped like the segment of an orange. Embryo small, cotyledons foliaceous.

1. **W. corymbosa,** *Willd.* Syn. Rondeletia asiatica, *L.*; Chomelia asiatica, *O. Kze.*; Tarenna zeylanica, *Gaertn.* (1788)*; Jaujoka, *Or.*

A dwarf or large shrub or a small tree attaining 20 ft. with glossy oblong or oblanceolate-oblong leaves 3–9″ long suddenly contracted to a short acute or acuminate tip and with 8–17 strong sec. n. sharply turned up close to the margin. Flowers sweet-scented white, ·4–·7″ diam., in 3-chotomous densely hirtellous corymbose cymes about 2″ diam. in flower or 3″ diam. in fruit. Corolla ·4″ long in the bud, tube ·15″, pubescent above, shorter than the petals which are villous within. Ovary-cells about 4-ovuled on spongy placentæ. Berry black, ·25″ diam., globose, crowned by the erect calyx.

Southern Tract only, and chiefly in Puri, a stunted bush on the laterite, where it is common, but becoming almost a tree in the mountains of the Southern Range! Fl. Nov.–Dec. Fr. Jan.–June. Evergreen.

Axils of the sec. n. gland-hairy. Petiole ·5–·7″ with a resinous secretion which also occurs on the nodes and inflorescence. Interpetiolar stipules with a broad persistent base and a deciduous triangular and cuspidate blade. Calyx ·12″ tubular above the hypanthium, hyp. and calyx together ·15–·16″ long in flower. Throat of corolla closed by white villi. Anthers sub-sessile ·2″ long. Style pubescent in middle, passing gradually into the large grooved stigma. Seeds 3–4 in each cell shaped like the segments of an orange.

12. GARDENIA, *L.*

Trees or shrubs, often resinous, armed in a few species with axillary thorns. Leaves opp. or 3-nately whorled, or sometimes fascicled in the thorny species, nerve-axils usually glandular. Fls. large or m.s., usually solitary terminal or axillary, more rarely fascicled, often dimorphic, white or turning yellow, corolla tube usually long. Petals 5–12. St. as many with sub-sessile linear included or only half-exserted anthers. Ovary 1-celled. Style stout, stigma clavate or fusiform, sometimes 2-cleft. Placentæ 2–5. Fruit a berry or drupe. Seeds many, imbedded in the placentæ, compressed. Embryo small, in horny albumen.

I. Thorny species. Fls. 1·5″ diam. or less, dimorphic.
Small tree. Cor. salver-shaped . . . . . 1. *turgida.*
Shrub. Cor.-tube campanulate . . . . . 2. *campanulata.*

* *Chomelia* is the oldest generic name, but is already in use for another American genus. *Tarenna, Cooke* states, is the next in priority, but I do not understand why *asiatica* is rejected as a specific name if *Rondeletia asiatica* is a synonym as stated by Willdenow (p. 1224).

II. Unarmed. Flowers 2–4·5″ diam. Sec. n. strong parallel.
L. 1·5–3″, subsessile, sec. n. 12–18. Fls. sessile . . . 3. *gummifera.*
L. 4–8″, petiole ·3–·5″, sec. n. 18–35. Fls. peduncled . . 4. *lucida.*
L. 4–6″, petiole ·1″, sec. n. 14–20. Fls. peduncled, lobes longer than the tube . . . . . 5. *florida.*
L. 6–10″, subsessile, sec. n. 12. Fls. peduncled, lobes shorter than the tube . . . . . 6. *latifolia.*

1. **G. turgida,** *Roxb.* Buniain, *Th.*; Dudni, Durdi, Duduri, *K.*; Karhar, *Kharw., Uran*; Dundukit', *S.*; Kharkar, *Mal. P.*; Dhauuk, *H.*; Kurdu, *Or.* (*teste Cooper*).

A straight small tree with narrow crown and white or pale grey rigid spreading branches armed with sharp straight thorns or some branches thornless. Leaves 1–4″, elliptic or usually obovate, glabrous or pubescent beneath or (var. *montana, Roxb.*) often orbicular and densely tomentose beneath. Fls. usually described as dimorphic and 1-sexual, but my specimens are 2-sexual (assuming that the pollen is fertile), when 1-sexual males fascicled, female or hermaphrodite flowers solitary apparently terminal, larger than the males with ovary about ·4″ long, calyx with the small linear-subulate teeth ·25″ long, corolla-tube glabrous, ·7″ long, tubular, scarcely dilated upwards, petals ·5″ oblong, anthers 5–6 (apparently perfect) linear quite sessile attached by their back, included, style ·35″, stigma large cylindric grooved with apex 2-lobulate. Fruit large, 1·5–3″ diam., globose grey, with fleshy pericarp and thin woody endocarp with 5 placentæ and densely packed with hard angular seeds.

Abundant in dry forests, especially on slopes of clay and quartz-stones. Also frequent in second-growth forest. Chiefly in the Central and Southern areas, rare in the Northern area. Fl. April–May, mostly when leafless, but also at other times. Fr. takes a year to ripen. Deciduous March–May.

Bark white or pale-grey; blaze with chlorophyll, then white with yellow specks, then cream-coloured (on wood). L. subsessile or narrowed into a very short petiole, sec. n. about 5, of which 1–2 close to base very oblique; stipules sheathing with triangular caducous limb. The male calyx is described as only ·17″ with wide truncate mouth and corolla-tube ·3–·5″. The hrm. fl. has an annular swollen disc round base of style.

The wood is close-grained and *Gamble* says "good," but except for temporary purposes does not seem to be used. *Gamble* gives weight as 56 lbs. Growth slow. *Innes* says the fruit is boiled and eaten when unripe, and when ripe becomes rather poisonous (as in *Ramdia dumetorum*).

2. **G. campanulata,** *Roxb.*

A shrub, 15–20 ft. with membranous ell.-obovate or oblanceolate leaves, 1·5–3″ narrowed into the short petiole, glabrous. Male flowers fascicled under ·5″ diam., fem. fl. ·3–·5″ with very short lobes, both campanulate. Fr. ·75–1·25″ diam., ellipsoid or sub-globose.

Recorded only by *Sir J. D. Hooker* and *Anderson* from Parasnath in our area, and perhaps extinct there as I have not found it. It occurs however in the Sikkim Tarai, and might therefore be found on the borders of Purneah. Fl. March. Fr. Nov.

3. **G. gummifera,** *L. f.* Bururi, *M.*; Burui, *Ho.*; Bruru, *Bhumij*; Dekamali, *H.*; Kurdu, *Or.*; Gururu (Angul).

A handsome shrub, sometimes 12 ft. with sessile or sub-sessile shining oblong to obovate leaves 1·5–3″, normally with a narrowly

cordate base but sometimes base cuneate. At certain seasons a clear drop of gum completely covers the leaf-buds. Fls. large, nearly sessile, with slender tube 1·8–2·5″ long and 5 oblong lobes 1–1·5″ by ·5–·75″. The sepals are triangular acute keeled and half-spreading, only ·1″ or less in the usual form but subulate-acuminate in var. Frt. 1–1·5″ ovoid or ellipsoid with fleshy mesocarp and hard thin endocarp, beaked with the calyx.

Central and Southern areas. In most of the districts except the Santal Parg. and near the sea, but very local! It occurs sub-gregariously on many of the dry hills with a clay soil derived from clay and quartz schists! Fl. March–May esp. in April when the bushes are bare of leaves. Fr. June–Aug.

Bark white, blaze white with chlorophyll. Twigs, leaves and inflorescence often covered with resin. L. rounded or obtuse, with 12–16 sec. n. with villous gland pits in their axils. Stipules connate truncate. Fls. sometimes 2–3 together terminal but becoming lateral in frt. Calyx ·2–·25″ with sepals sometimes subulate. Corolla-tube often densely pubescent.

It yields a clear yellow resin from wounds in the bark, and the resin is also collected from the leaf-buds. It is the Dikamali or Cambi Resin used externally as antiseptic and stimulating, internally as carminative and anti-spasmodic, also as an anthelmintic. Useful in flatulent dyspepsia (*Nadkarni*). The fruit is eaten in July and August.

Var. **gummiferoides,** *Haines* (*C. P. List* wrongly placed under *G. lucida*).

This plant appears in some respects intermediate between *G. gummifera* and the next species, but if not a hybrid it is certainly more closely allied to *gummifera*. It has now been observed in fruit.

A small tree about 20 ft. with a clear bole having the bark of *gummifera*. Leaves attenuate at base and often subacute, sec. n. 14–18. Calyx ·3–·4″ puberulous with subulate acuminate sepals with filiform tips as in *lucida* ·2–·25″ long. Corolla-tube 1·5–2″ long puberulous. Anthers half-exserted. Fruit as in type but verrucose.

Sambulpur! This is also the only district in the province where *G. lucida* occurs. The half-exserted anthers is probably a sexual character.

4. **G. lucida,** *Roxb.* Dekamali, *H.*

A handsome shrub attaining 25 ft., branched low down, with elliptic-oblong distinctly petioled leaves 4–8″ long either acute both ends or the large adult leaves with broad rounded base shortly cuneate on the petiole, sec. n. 18–35. Fls. large white fragrant peduncled mostly lateral with calyx ·3–·7″ long, the sepals linear-subulate or subulate-acuminate much longer than the tube, corolla-tube 1·5–2·5″ puberulous. Fruit oval or ovoid ·8–1·2″ long, dry with thin shell and crowned with the slightly enlarged calyx often ·6″ long or more.

Sambalpur, Boropahar Range on the shales in the Nakti Chaptar forest, locally abundant! Fl. April–July with the young leaves. Fr. April–June (of following year). Evergreen but old leaves fall just before flowering.

The bark is usually more grey than in the last. The adult leaves are very different and usually dark green with a petiole ·3–·5″ long. Stipules at first large or oblong on the bud, but the blade deciduous, sometimes however persistent and up to ·7″. Leaves sometimes puberulous. Peduncle ·3–·6″.

The gum has the same properties as in *G. gummifera*. For sowing I find it preferable to separate the numerous seeds, though in nature a whole fruit will rot and the seeds germinate in a heap. The seedlings do best in partial shade.

5. **G. florida,** *Willd.* Gundha-raj, *Vern.*; Gardenia, Cape Jasmine.

A large shrub with varnished shoots and buds, opposite or ternately whorled obovate or oblanceolate or nearly elliptic strongly-nerved leaves 4–6″ by 1·5–2·7″ and solitary very fragrant large white, often double, flowers terminal in the forks of the branches or becoming lateral by displacement on single shoots.

A native of China, very common in Indian gardens, and as some of the other *Gardenias* are also cultivated a detailed description is given. Fl. Sept.–April.

Shoots puberulous. Buds compressed ·3–·5″ long. L. tapering below the middle to a very short petiole about ·1″ long only, shining and dark-green, glabrous except the shortly tufted glandular axils of the 14–20 sec. n. which are pale beneath and upturned just within the margin, uniting with the next, intermediate and tertiaries simple or some reticulating. Stipules usually united spathaceous or 2-cleft, ·4–·5″ long. Peduncles ·3–·5″. Calyx with the ovary 1·2″, 5-6-ridged with the ridges ending in long subulate sepals laterally compressed at base and ·6–·7″ long. Corolla-tube very stout ·75–1″ by ·2–·35″ broad, wider above, lobes (or in double flowers, outer lobes) obovate or oblanceolate 1·2–1·5″ long. Berry ellipsoid, orange, strongly ribbed.

6. **G. latifolia,** *Aiton.* Papa, *Ho.*; Papara, *M., H.*; Popro, *S.*; Pempri, *Mal P.*; Gogal, *Gond.*; Damkurdu, *Or.*; Dambaru (Mayurbhanj).

A very handsome small tree with a round low crown of large opposite or 3-nate broadly-elliptic or orbicular or, when young, obovate leaves, which sometimes reach 15″ by 6″. Flowers large solitary white 3–4″ diam., usually borne when the leaves are small. Calyx somewhat mealy and pubescent, somewhat ridged by the decurrent sepals which are very unequal subulate and end in a hair, tube (excluding ovary) with the teeth ·5–·8″ long. Corolla tube 2–2·5″ long funnel-shaped above, hairy, lobes 5–9 usually over 7, anthers partly exserted (always ?). Fr. 1·5–2″ diam. globose, slightly scabrous.

Chiefly in rocky hills and especially along rocky nalas throughout the Central and Southern areas! Fl. chiefly in April when leafless, and with new leaves in May, but also at other times. Fr. found at all times from Dec. to June, ripens about 8 months after flowering chiefly in the r.s. Deciduous March–April.

Bark quite smooth, very pale, shoots stout, buds resinous. Young leaves closely pubescent beneath, obtuse or rounded, base narrowed sub-sessile, sec. n. about 12, strong, reaching nearly to margin, glandular hairy in the axils beneath. Stipules with a broad ovate and cuspidate deciduous limb, the lower part persistent connate sometimes becomes detached at the base and remaining as a movable tube ·2–·25 long on the twig. Peduncles short. Scent of flowers strong and heavy. Endocarp woody.

The tree is remarkably xerophytic. The seeds often germinate in the crevices of bare rocks, over which the stem forms a large cushion. It is also sometimes epiphytic on trees.

The wood is made into combs in Sambalpur. The fruit is eaten. *Gamble* recommends the wood to be tried as a substitute for boxwood stating that it is also easy to work and durable. Weight 51 lbs.

13. RANDIA, *L.*

Small trees or shrubs, often armed with strong axillary thorns. L. often fascicled on short branches and when opposite one of the pair sometimes arrested, stipules short intrapetiolar free or connate. Flowers large or m.s. solitary or fascicled or in axillary or leaf-opposed cymes white or turning yellow with age, often dimorphic. Corolla-tube usually short. Anthers sub-sessile linear or oblong exsert or partly so. Ovary 2- rarely 3–4-celled. Stigma usually

large, fusiform. Fruit a 2-celled many-seeded berry. Seeds angled, cotyledons orbicular.

I. Corolla-tube short broad or campanulate, shorter than petals.
  A. Flowers large or m.s., solitary or few and fascicled. Sepals broad.
    L. 3–8″ oblong or elliptic. Cor. 1–2″ diam. Fr. 2″–2·5″ . 1. *uliginosa*.
    L. 1–3″ obovate. Cor. ·5–1·5″ diam. Fr. ·75–1·25″ . . 2. *dumetorum*.
  B. Flowers ·6–·8″ diam. Sepals very short deltoid. Fr. ·4″ . 3. *malabarica*.
II. Corolla-tube slender ·5–1·25″. Sepals linear . . . . 4. *fasciculata*.

1. **R. uliginosa,** *DC.* Syn. Posoqueria uliginosa, *Roxb.*; Pirar, *Th.*; Perar, *H.*; Kumbikum, *K.*; Pendra, Pinde, *S.*; Pindaro, *Mal. P*, (also in Purneah); Piralo, *Beng.*; Mohwan (Koderma); Telkur. Tolkor, *Or.*

A small tree or a shrub with thick black branchlets, handsome when in flower, with large elliptic or oblong more rarely obovate fascicled leaves 2–8″ by 1–4″ and numerous solitary pure white flowers 1–2″ diam. or the males corymbose. Hypanthium with short calyx together ·5–·6″ long, turbinate, sepals 5–7 very broad, obtuse or rounded. Berry large ellipsoid 2–2·5″ long.

Throughout the province, in the plains and valleys in the hills, nowhere very common except on cotton soil. Fl. May–July. Fr. Dec.–Feb. Leaves turn colour in Dec. and Jan. and the bush is usually leafless Feb.–April.

It varies much in thorniness being sometimes quite unarmed, thorns sometimes ternate. Leaves obtuse or rounded or acute at apex narrowed at base into a very short petiole, when quite young hairy on the 6–8 strong sec. n. beneath. Stipules broad rounded or triangular. The flowers are described in the *F.B.I.* as either large and sessile or small and peduncled and the calyx-tube as 1·5″, but some flowers 1·5″ diam. have a peduncle over 1″ long and 1½″ is probably a misprint for ½′. Corolla-tube not much exceeding the calyx, petals orbicular. "Tube of the large form with a ring of hairs inside and a fusiform 2-lobed stigma, that of the small form is glabrous within and with entire stigma," *F.B.I.* Stamens 5–7. Scales round base of style (in fem.) 5–7. Seeds compressed smooth.

The fruit is eaten and makes a good vegetable when cooked.

2. **R. dumetorum,** *Lamk.* Syn. Posoqueria dumetorum, nutans, longispina and floribunda, *Roxb.* (*F.I.*); Mana, *Th.*; Mainphal, *H.*; Manda (Gaya), Mowan, *Khar.*; Potua. Potab, Portoho, *K.*; Loto, *S.*; Mohana, *Or.*; Potwaphal (Sambalpur).

A small tree or large shrub usually armed with straight axillary thorns. Leaves mostly clustered on short branchlets oblanceolate to obovate obtuse or shortly acuminate 1–3″, the base narrowed into a short slender petiole ·2–·4″ long. Flowers white, turning yellow ·5–1·25″ diam., solitary terminal on new shoots or in 3–4-fld. sessile cymes, subsessile or with pedicels ·5″. Calyx-tube strigose, sepals ovate or obovate lanceolate or oblong. Corolla-tube campanulate ·25–·4″ long, lobes ultimately reflexed obovate, oblong or oblanceolate. Berry globose or ovoid, yellow when ripe, 1–1·5″ diam. crowned by the calyx-tube.

Throughout the area, common in the plains and valleys. Fl. April–June. Fr. Aug.–Jan. Leafless March–April.

Bark nearly smooth but fissured with fine lines, grey; blaze thick soft pink or reddish. The thorns increase in number and size according to the vigour of the tree and are especially long on young coppice shoots. Leaves sometimes 3·5–4·5″ and elliptic-obovate, glabrous or pubescent beneath. In the Singbhum plant with the flowers in sessile 3–4-fld. cymes the sepals are lanceolate or oblong and corolla tube ·3–·4″ long softly silky or pubescent but the solitary and cymose forms are I

believe the same species as in some other *Randia* and *Gardenia*. Endocarp of fruit fleshy white. Seeds many embedded in brown pulp.

The fruit is used to intoxicate fish. It has a most agreeable smell, but produces an uncomfortable burning sensation in the throat. The Kols say that it is not edible. Mr. Innes (*Report on Famine Foods*) states that when unripe it is boiled and eaten but the ripe fruit is rather poisonous. *Campbell* states that it is applied externally in fever and that the bark is given internally and externally for fever, and that it is also used as a dye. *Nadkarni* says that the rind and fruit have useful emetic, diaphoretic and antispasmodic properties. The bark is a sedative and nervine carminative.

N.B.—Wight and *Arnott* in the Prodromus keep *Randia longispina* and *R. dumetorum* distinct. The following points of difference are taken from their work omitting non-contrastable characters: *

R. dumetorum. L. oval cuneate at base. Fls. solitary terminal, calyx-lobes oblong. Fr. globose, rarely oblong.

R. longispina. L. obovate to oblong, cuneate at base. Fls. usually 1-3 terminating short axillary shoots, rarely solitary axillary. Calyx-lobes ovate with often a small tooth in the sinus. Fr. short ovoid, slightly retuse at base.

Both these forms occur in our area as well as others.

Roxburgh, who apparently had both his *Posoqueria longispina* and *Konig's P. dumetorum* growing under his eye, and who seldom errs in the discrimination of species, states that *P. longispina* differs very conspicuously in the long slender spreading and drooping branchlets, in the limb of the calyx being permanent and the fruit obovate, whereas *Randia dumetorum* has short and rigidly erect branchlets, globose berry, and the calyx-limb deciduous. Unfortunately *W. & A.* state that the calyx-limb is permanent in both! Certainly some individuals have the limb deciduous, but whether this character is associated invariably with others or whether even constant in the same individual can only be fully determined in the field.

3. **R. malabarica,** *Lamk.* Syn. Gardenia fragrans, *Koen.*; Griffithia fragrans, *Wight*; Phirika, *Or.*

An erect very rigid thorny shrub 4–8 ft. with grey divaricate branches and numerous abbreviated branchlets or leafy fascicles. Leaves glabrous ·7″ to nearly 3″ oblanceolate to obovate or some elliptic-oblong, subsessile or narrowed into a short petiole ·3″ long. Flowers white salver-shaped ·75″ diam. in dense sessile corymbs or sub-umbellate cymes. Very pretty in fruit from its numerous umbellate globose scarlet berries ·4-·6″ diam. with a depressed areole.

Orissa, very common near the coast from Balasore southwards! Very common on the Khandagiri sandstones but also found on laterite. Fl. chiefly March–May. Fr. Oct.–Dec.

Leaves shining coriaceous with slightly recurved margins, sometimes rather fleshy close to the sea and round the Chilka Lake, apex obtuse or rounded, sec. n. 3–4 with ciliate glandular pits in their axils beneath. Rhachis of corymb very short, pedicels ·25-·3″ bracteate and sheathed at base with 2 connate bracteoles. Calyx tubular ·17″ lobes very short deltoid. Corolla-tube ·3″, petals ·3-·4″ oblong. Fruit 2-celled with 1–several seeds in each cell.

This species is sometimes placed in a separate genus *Griffithia* (*G. fragrans, W. & A.*) on account of the decidedly deciduous calyx which separates by a transverse crack from the apex of the ovary.

4. **R. fasciculata,** *DC.*

A shrub or small spreading tree copiously armed with axillary erecto-patent thorns ·5″ long. Leaves small 1–3″ elliptic or ovate obtuse or acuminate. Flowers white fragrant 1″ diam. with tube usually ·9″ long, mostly in 3-fld. cymes at the ends of the short

* Since completing the family the 4th part of the *Flora of Madras* has been published. *Mr. Gamble* separates the two forms as species and there is a note on the subject in *Kew Bulletin*, No. 8 of 1921.

branchlets, sometimes also axillary. Berry black ·25–·3″ diam. with 10–12 angled seeds.

Northern Purneah! Ravines in Singbhum, rather rare! Fl., Fr. Dec.–May.

Twigs pubescent. Leaves thinly hairy on and in the axils of the nerves beneath, base obtuse or acute, sec. n. 3–5. Petiole ·1–·25″, stipules deciduous broad and short with a long linear cusp. Cymes on peduncles ·2–·3″ long or sessile between a pair of leaves. Fls. subsessile. Calyx-tube above the ovary nearly ·1″, sepals ·2″ linear with broad base and sometimes slightly dilated at tip, thinly hairy. Corolla-tube ·5–1·25″ in some specimens, petals broadly oblong, sometimes apiculate, base hairy. Stigma large mitriform, shortly exserted. Berry marked with a prominent areole.

14. IXORA, *L.*

Small trees or shrubs with opp. or ternate leaves and flowers in terminal 3-chotomous often corymbose cymes, 4- very rarely 5-merous. Hypanthium small. Calyx with small 4-toothed persistent limb. Corolla-tube very long and slender with 4 spreading lobes. Stamens on the mouth with usually very short or obsolete filaments and slender exserted linear anthers with 2-fid base. Ovary 2-celled, style filiform exserted but never twice as long as corolla-tube, stigma slender at first fusiform, afterwards usually dividing into two branches. Ovules 1 in each cell peltately attached to the septum. Fruit with two plano-convex or ventrally concave coriaceous pyrenes. Seeds peltate. Cotyledons flat thin, radicle inferior.

Wild Species:

Leaves acuminate. Lower cyme-branches 2″ long or more. Cor.—tube over ·26″ . . . . . 1. *undulata.*

Leaves subsessile, rounded. Cyme branches usually under 2″ long . . . . . 2. *parviflora.*

Garden Species:

A large number of garden species of *Ixora* are in cultivation in gardens. The two most common, and also most beautiful, are—

3. **I. coccinea,** *L.* A compact shrub with shining oblong sessile leaves 3–4″ long and bright scarlet flowers in large handsome compact corymbs. The petals are acute. Peduncles and pedicels coloured like the flowers.

4. **I. stricta.** *Roxb.* Less compact in habit with sub-sessile, oval or oblong, leaves 5–6″ long and large compact convex corymbs of flowers of a salmon-scarlet colour. The petals are rounded.

1. I. undulata, *Roxb.* Chadaigodi, *Or.*

A large shrub with oblong or lanceolate shining leaves 5–9″ by 1·5–3·3″ glabrous, acute or usually acuminate, and mostly with undulate margins. Petiole ·5–1″ long. Flowers white, odorous, corymbose on the slender branches of long peduncled brachiate panicles. Cor.-tube ·28–·32″ long, petals spreading and reflexed ·16–·18″ long. Fruit succulent ·3″ diam. dull-purple or slate-coloured with two plano-convex pyrenes.

Not very common and always in the vicinity of water. Santal P., fairly frequent! Singbhum, in the Saranda forests! Manbhum and Hazaribagh, on Parasnath! Hundrughagh (Ranchi), *Prain!* Keonjhur, *teste Grieve!* Bonai, *Cooper!* Mayurbhanj, elev. 2500 ft.! Puri (Kuhuri forest and in the Mals)! Fl. April–May. Fr. Aug.–Sept. Evergreen.

Blaze pink, then white. L. usually tapering both ends and distinctly petioled though some of the leaves on the Ranchi specimens are scarcely petioled, sec. n. 12–16 with many rather irregular intermediate, all very slender. Stipules broad and rounded but with a slender cusp. Panicles 6–8″ long often with a slender peduncle 3″ long, at other times a branch arises at its base, internodes long and elongating in fruit, lower bracts ·3″ long sometimes with a broad toothed base,

upper bracts narrowly linear. Flower-buds slender clavate, ·45″ long. Calyx with ovary only ·05–·06″ long. Pyrenes slightly concave with a slightly curved embryo, long radicle and ovate cotyledons.

2. **I. parviflora,** *Vahl.* Pete, *K.*; Merom met', *S.*; Datranjin, *Kharw.*; Kholan, *Ghatw.*; Konthra, *Mal P.*; Kota Gandhal, Loha jangia, *H.*; Rangan, *Beng.*; Telkurwan, Telkuria, *Or.*; The Torch-tree.

Usually a small tree, more rarely a large shrub, with smooth very coriaceous, oblong or elliptic, sub-sessile leaves 3–6″ by 1·5–2·5″ obtuse or rounded at the apex and with rounded or cordate base. Flowers white odorous sub-sessile, in usually very compact panicles 2–4″ rarely 6″ long, branches brachiate or ascending 1–1·5″ long only. Cor.-tube ·22–·25″ long, petals spreading and reflexed, very obtuse, ·15″ long, sometimes 5 in number and size of flower somewhat variable. Anthers tailed. Fruit ·25–·3″ diam., depressed globose shining black (never didymous when fresh).

Common throughout the Central and Southern areas, often in Sal forests and near nalas, but also in dryer localities than the last. Fl. March-May. Fr. May–June. Evergreen.

Trunk often 18″ girth with pale-grey nearly smooth bark and flesh-coloured blaze. Sec. n. about 12–14 very fine and inconspicuous, soon reticulating. Petiole sometimes ·2″ long, stout.

The branches are used as torches in Sambalpur. The fruit is eaten in Chota Nagpur.

15. PAVETTA, *L.*

Very like *Ixora* but the stipular bracts on the inflorescence and the leaves more membranous, stipules more united into an intrapetiolar sheath, style twice as long as the corolla-tube or more with the slender stigma not 2-fid and rarely notched, and the ovules usually attached to a prominent placenta. Frt. (in our species) baccate and usually 1-seeded only.

1. **P. indica,** *L.* Sikriba, Sikiba, *K.*; Buddhi-ghasse, *S.*; Budhi, *Kharw.*; Jui, *Beng.*; Kuku-chalia, Macharanka, *Or.*

A large shrub or small bushy tree with elliptic or obovate glabrous, pubescent or tomentose leaves 3–9″ long and large trichotomous corymbose panicles of slender white flowers ·5–·75″ long with very slender styles exserted ·7–1″ beyond the mouth of the corolla. Fruit globose black ·3″ diam. with usually 1 seed only (*Roxb.* says usually 2).

Throughout the whole area, plains, valleys and shady slopes of the hills in the damper forests but not very common except in Angul. Fl. June-Aug. Fr. Oct.–Jan. and shrivelled berries may be found in other months. Deciduous.

L. acute or obtuse, rarely acuminate, base cuneate, sec. n. 11–15 strong. Petiole ·5–1″. Stipules broader than long with cuspidate tips. Panicles 4–8″ diam., bracts stipular with or without the more or less rudimentary leaves at the base of the lower branches, with scarious or membranous margins. Petals oblong-oblanceolate, ·2″, tip rounded. Anthers exserted ·17–·2″. Seed sub-globose enclosing the placenta on one side. Embryo curved.

The *F.B.I.* distinguishes several varieties of which the following occur:

α. **indica** *proper.* Leaves glabrous beneath or nearly so, cymes nearly glabrous, corolla glabrous. Champaran! Purneah! Angul!

β. **tomentosa.** Leaves softly pubescent or tomentose beneath, sometimes also puberulous above. Cymes pubescent, tomentose or villous. Corolla glabrous. The common form in the rest of the province!

16. COFFEA, *L.*

Shrubs with broad stipules and white or yellowish m.s. flowers in axillary or terminal fascicles or solitary or axillary dense cymes. Hypanthium short, calyx tube short or 0, often glandular, persistent; sepals often minute or 0. Corolla-tube short or long with 4–7 spreading lobes twisted in bud. Anthers 4–7 sessile, often recurved or twisted. Ovary 2-celled, style filiform with 2 linear or subulate branches. Ovules 1 in each cell peltately attached to the septum. Fruit a drupe with 2 plano-convex or ventrally concave coriaceous or cartilaginous pyrenes. Seeds concave or grooved ventrally, albumen horny, embryo short towards base of seed, curved, cotyledons thin cordate, radicle inferior.

A. Deciduous. Leaves ovate. Corolla-tube ·7–·8″ long . . . 1. *bengalensis.*
B. Evergreen cultivated species. Leaves narrow.
L. ell.-oblong. Fls. in close cymes. Cor.-tube ·35–·5″ . . 2. *arabica.*
L. ell.-oblong or ell.-oblanceolate. Fls. sub-solitary. Cor.-tube ·2–·25″ . . . . . 3. *liberica.*

1. C. bengalensis, *Roxb.* Banamali, *Or.*

A pretty shrub 3-4 ft. high with bright green ovate acuminate leaves 3–4″ by 2–2·5″, setaceous-tipped stipules ·17–·2″ long and pure white salver-shaped flowers, 1–1·5″ diam. with a tube ·7–·8″ long. Fruit an ovoid black drupe ·4–·5″ long with 1–2 pyrenes. Seed grooved.

In the damper regions. Champaran and Purneah! Forming semi-thickets in damp low ground under dense shade in the Singbhum forests, but rare! Mayurbhanj, elev. 2500 ft.! Mals of Puri! Fl. with the new leaves, rarely when quite leafless, April–May. Fr. Jan.–April. Deciduous Feb.–April.

Leaves hairy on the nerves beneath when young; sec. n. 3-5 slender, petiole ·17–·26″. Fls. sessile 1-3 in a fascicle terminating the shoots, sometimes on new shoots with 4 lanceolate bract-scales at the base and a single pair of leaves supporting the fascicle, sometimes axillary (according to the floras). Calyx obsolete or of several minute glandular teeth. Petals ·5–·9″. Anthers ·3″ sessile apiculate, the tips only exserted. Style short.

The coffee is of little use according to *Roxburgh*, and I have never heard of the natives making any use of it.

2. C. arabica, *L.* Arabian Coffee.

A handsome evergreen bush with compressed spreading branchlets and bifarious oblong or elliptic-oblong shortly acuminate glabrous and shining leaves 4–8″ long with rounded or subacute base and petiole ·25–·4″. Stipules broadly lanceolate with a long or short subulate cusp ultimately broadly semi-orbicular and the cusp deciduous. Flowers white 1-3-nate or in abbreviated 1–2-nate axillary cymes, sub-sessile, subtended by short amplexicaul green bracts. Cor.-tube ·3–·45″. Petals 5, ·4–·65″. Drupe oblong with 2 pyrenes (the well-known coffee beans).

Often cultivated for ornament and on the Ranchi and Hazaribagh plateaux, also for coffee for local consumption. Native of Abyssinia. Fl. March. Fr. Dec.

Leaves with 10–12 sec. n. looped and with large gland-pits, sometimes double, in their axils. Cymes sometimes with foliaceous bracts at their base. As it renews its leaves between the time of flowering and fruiting the fruits are mostly from leafless nodes.

3. **C. liberica,** *Bull.* Liberian Coffee.

A stouter bush or small tree with stiffer less distichous leaves and less handsome. Leaves 7–8″ long elliptic-oblong or elliptic-oblanceolate, stipules obtuse, not cuspidate. The flowers are mostly solitary at the crowded nodes subtended by a double calyculus (connate bracteoles). Corolla-tube ·2–·25″. Petals often 7–8 oblong ·4–·6″. Drupe purple, ·75–1″ long.

Occasionally cultivated. Fl. March. A native of Guinea.

Base of leaf cuneate on a petiole ·5–1″ long, sec. n. 6–10 with large gland-pits at the base of most of them, pits usually surrounded by a ring of pubescence. The buds and twigs are in my specimens covered with a resinous deposit as in *Gardenia*.

17. CANTHIUM, *Lamk.*

(Plectronia, *L.*, in part, and the name adopted in some works.)

Shrubs or small trees, sometimes armed with axillary thorns. Leaves with nerve-axils often glandular. Stipules connate. Fls. small in axillary fascicles or corymbose cymes, white or greenish, sometimes polygamous. Hypanthium and calyx short, 4–5-toothed. Corolla usually globose or urceolate, sometimes companulate or funnel-shaped, a ring of deflexed hairs within and throat villous, lobes small, 4–5, valvate. Anthers 4–5, subsessile on the throat or mouth. Ovary 2-celled, style stout, stigma large. Ovules 1 pendulous in each cell. Drupe globose or didymous with 2 pyrenes or 2-celled putamen, or one carpel sometimes suppressed and then oblong or reniform Seed oblong. Embryo long with short cotyledons.

I. Trees or large shrubs without thorns. Leaves over 3·5″ long.
  Trunk straight erect. L. 5–9″. Cymes glabrous. Fr. ·8″ . 1. *glabrum.*
  Branches low. L. 4–6″. Cymes dense pubescent. Fr. ·3″ . 2. *didymum.*
II. Shrubs with copious axillary thorns. Leaves under 3·5″ long.
  Leaves glabrous. Flowers 4-merous . . . . . 3. *parviflorum.*
  Leaves pubescent. Flowers 5-merous . . . . . 4. *parvifolium.*

1. **C. glabrum,** *Blume.* Ranisera, *Or.*

A small or m.s. tree with spreading green branches and spreading bifarious dark green leaves 5–8·5″ long, ovate- or oblong-lanceolate or elliptic, quite glabrous, tapering or suddenly acuminate, base rounded or cuneate on the petiole, sec. n. 5–7, some with pit-glands in their axils, tertiaries obscure. Petiole ·3–·5″. Stipules with broad thickened base and a subulate keel ending in a sharp acumen, about ·2″ long. Cymes shortly-peduncled, 1–2″ long and broad in fruit, glabrous and rather lax. Fls. (not seen in my specimens) 5-merous, pedicelled. Fruit globose green ·8–1″ with a conspicuous areole ·25″ diam. on top, and two one-seeded pyrenes, triangular in transverse section.

Mals of Orissa, 2000 ft. in valleys! Fl. probably r.s. Fr. Dec.–Jan. Evergreen.

Trunk straight with smooth bark, blaze finely striated red and yellow. L. sometimes 9″ by 5″, paler beneath, base decurrent as a ridge either side of petiole. Peduncle about ·3–·5″, pedicels (in fr.) ·3″. Corolla-tube sub-globose, ·08″, lobes as long. Stigma mitriform notched.

2. **C. didymum,** *Roxb.* Syn. Plectronia didyma, *Kurz.*; Jur., *K.*; Garbha gojha, *S.*; Rangruri (Ranchi); Dalsing, Kumar-chikni, *Or.*; Beniman (Sambalpur).

A low-branched tree or large shrub with spreading or drooping branchlets flattened at the upper extremities. Leaves bifarious, dark green ovate or lanceolate-ovate, acuminate, 4–6″ by 2·5–3″, base rounded or cuneate often unequal, sec. n. 3–5, some with gland-pits in their axils. Petiole ·3–·5″. Cymes sessile or shortly peduncled, pubescent or puberulous, very dense, ·7–1″ long and broad. Flowers 5-merous, greenish or white, ·2″ long and ·25″ diam., corolla with campanulate tube and rotate lanceolate petals. Frt. black globose or slightly longer than broad, ·3″ with 2 oblong nearly terete pyrenes.

Central and Southern areas. A very common tree along the edges of streams and dry watercourses in all the forest districts. Fl. Feb.–April. Fr. May. Evergreen.

Bark smooth but with vertical cracks, dark grey. Leaves shining above, pale beneath, tertiary nerves indistinct. Stipules variable, deltoid or linear or, in one variety in Puri, one of each pair becoming large and foliaceous as in *Mesoptera*! Peduncles usually very short and stout having connate bracts at the apex subtending the cyme-branches, which are at first 2-3-chotomous and then scorpioid. Pedicels ·1–·5″ long with very minute bracts at their base. Hypanthium with the small deltoid sepals ·05–·07″, sometimes glabrous. Stamens on mouth of corolla with short filaments. Style long, stigma mitriform. Pyrenes slightly rugose in some plants.

I have never seen the fruit didymous in its natural state, though it may become so when dried. The pedicels are often recurved in fruit.

The wood is used to a slight extent for handles of implements, etc. *Gamble* states that it has a great resemblance to boxwood and is hard, close- and even-grained. Weight about 50 lbs. The bark is said to be used for killing fish in Sambalpur so it probably contains much tannin.

3. **C. parviflorum,** *Lamk.* Syn. Plectronia parviflora, *Bedd.*

An intensely thorny glabrous shrub with obtusely 4-angled twigs, opposite and decussate slender very strong and sharp thorns from above all the axils, and fascicles of small leaves and small green flowers in short sessile cymes below the thorns. In fruit the leaves are mature, ovate or elliptic, 1·5–3″ long, with the base narrowed into a short slender petiole. Fruit yellow sub-globose ·75″ diam. on peduncles about ·5″ long, apical areole often surrounded by the 4 short linear deciduous sepals.

Puri, rocky hills near the coast! Fl. April–May. Fr. Nov.–Dec. Deciduous March–April when the young leaves appear with the flowers.

Bark grey with longitudinal flakes. Thorns ·5–1·5″. There is often a fascicle of leaves below the thorns due to the development of an axillary bud, the subtending leaf of which has fallen. Leaves at time of fl. ·3–·7″ obtuse, sec. n. 3–5 slightly raised, translucent. Stipules minute subulate. Cymes shorter than the leaves, mostly bifurcate from the base and then 3-chotomous. Fls. 4-(–3)-merous, ·15–·2″ diam. Calyx minute toothed. Cor. campanulate to globose with spreading ovate lobes, mouth villous. Anthers on the mouth, sessile, exserted. Stigma large capitate, slightly 2-lobed.

The ripe fruit is eaten and the young leaves used as a sag.

4. **C. parvifolium,** *Roxb.*

A mod.-sized rigid much-branched thorny shrub with the shoots and leaves beneath hairy. Leaves ·5–1·5″ ovate or elliptic, subacute. Petiole very short. Flowers 5-merous sub-sessile axillary crowded.

Corolla sub-globose, lobes lanceolate acute. Fruit sub-globose, compressed, ·3″ diam., putamen tubercled.

Monghyr, *Hamilton*! Fl. r.s.
I have not seen this species in the field.

18. VANGUERIA, *Juss.*

Only differs from *Canthium* in that the ovary is 3–6-celled and the fruit with 3–6 pyrenes.

Leaves and pedicels glabrous. Corolla with mouth woolly, anthers exserted, petals not acuminate, anthers exserted horizontal . . . 1. *spinosa.*
Leaves and pedicels pubescent. Corolla mouth scarcely villous, petals with acuminate tips, anthers included erect . . . . 2. *pubescens.*

1. V. spinosa, *Roxb.*

A large shrub armed with long straight supra-axillary thorns. Twigs lenticellate. Leaves elliptic or ell.-ovate acuminate 3–4″, glabrous except sometimes tufts of hair in the axils of the sec. n., rarely thinly hairy, sec. n. 5–6 looping within the margin and intermediate nearly as strong. Flowers in sessile cymes in the axils of the new leaves. Hypanthium very short, broader than long, with 5 minute linear or subulate sepals. Corolla sub-globose green ·14″ long and broad, not ribbed within, mouth densely villous or woolly, lobes spreading ovate with cuspidate but not acuminate tips, ·12″ long, margins narrow white. Anthers spreading horizontally on the mouth. Ovary half superior, 5-celled. Style long, stigma large lobed. Fruit 1–1·5″. (*Roxburgh*, however, says only as large as a cherry.)

Purneah! Fl. April–May. Fr. Dec.–Jan.
This is the plant which runs through Eastern Bengal and Sikkim and ascends the mountains to 4000 ft. It appears to me to be distinct from the next, with which it is united in the *F.B.I.*

2. V. pubescens, *Kurz.* Syn. V. spinosa var. mollis, *F.B.I.*; Serali, Kataiara, *K.*; Boi-bindi, *S.*: Monphal, *Kharw.*; Moyena and Mainphal, *H.* (through confusion with Randia?); Gurbeli, *Or.*

A small tree or large shrub, often armed with long straight supra-axillary thorns. Leaves ovate elliptic or oblong acute or acuminate, 3–6″ sometimes 6″ by 3″, usually only 1–2·5″ at the time of flowering, more or less pubescent. Flowers small green sub-globose in dense axillary cymes. Corolla green sub-globose ·12–·13″ long and not quite as broad, tube with prominent ribs within, throat thinly villous, the hairs hardly showing at the mouth, never densely woolly at mouth as in last, lobes triangular acuminate or caudate. Anthers wholly or partly included, erect and smaller than in last species. Style long, stigma grooved. Fruit ·7–1″ diam.

Central and Southern Tracts, usually near ravines and nalas. Shahabad (Kaimur Hills)! Chota Nagpur! Santal P.! Gaya! Angul! Sambalpur! Kalahandi!
Fl. April–May with the new leaves. Fr. Aug.–Dec. Leaves turn yellow in Jan. and drop about March.
Twigs rarely lenticellate, often hirsute, sometimes nearly glabrous. Leaves usually acuminate, base rounded or cuneate on the petiole, sec. n. 5–7 always pubescent beneath. Petiole ·2–·4″. Stipules short and broad, very obtuse, caducous. Pedicels hairy and a few hairs sometimes on corolla. Fruit with 5–6 radiating flattened pyrenes or fewer by abortion.
The young leaves are eaten as a vegetable. The fruit is also eaten. The tree is

sometimes unarmed. Some thorny forms somewhat resemble *Randia dumetorum* and the fruit is sometimes said to kill fish, possibly through confusion with that plant.

19. LASIANTHUS, *Jack.*

Shrubs. Leaves distichous with arching sec. n. and close-set cross tertiaries and with broad, rarely narrow, interpetiolar stipules. Flowers small in axillary rarely peduncled often bracteate clusters, cymes or heads. Hypanthium short, calyx-tube short or long with 3–7 teeth, rarely truncate, persistent. Corolla funnel- or salver-shaped, throat villous, lobes 3–7 valvate in bud. Stamens 4–6 on the throat, filaments short, anthers often apiculate, included. Ovary 4–9-celled, style-arms or stigmas 3–9 short obtuse. Ovules 1 linear basal erect in each cell. Drupe small with 3–9, 3-quetrous and 1-seeded pyrenes. Embryo terete, radicle inferior.

1. **L. truncatus,** *Bedd.*

A shrub 4–6 ft. somewhat resembling *Heptianthera stricta*, with appressed shortly pubescent branchlets, lanceolate acuminate leaves about 5·5 to 1·5″ and axillary fascicles of sessile inconspicuous white flowers. Fruit blue succulent ovoid downy crowned by the calyx, with 4–5 pyrenes.

Deep shady valleys in the Tholokabad forest, Singbhum! Very rare. Fl., Fr. April–May.

Leaves often undulate and variegated yellow, pubescent on the nerves beneath, narrowed both ends, with 7–9 oblique arched sec. n. strong beneath and numerous sub-parallel cross nervules, petiole ·17–·25″. Stipules triangular long-acuminate strigosely pubescent. Calyx-tube short 3-toothed or truncate in fruit. Corolla tubular, pubescent, sometimes calyptrate. Anthers 5 sessile. Ovary 4–5-celled.

Only previously reported from Ganjam!

20. PSYCHOTRIA, *L.*

Shrubs or small trees with intra-petiolar sometimes connate stipules with often glandular axillary hairs. Flowers in terminal cymes, heads or fascicles. Hypanthium short, calyx-tube hardly any, sepals small persistent (in our species) or often deciduous. Corolla-tube straight, short, petals usually 5, valvate. Stamens on the throat or mouth, anthers included or not. Ovary 2-celled, style branches 2. Ovule 1 basal erect in each cell. Fruit small with one to two 1-seeded plano-convex pyrenes. Seed plano-convex, ventrally flat or grooved, albumen sometimes ruminate. Cotyledons broad thin.

Leaves 3–6″. Cymules in a spiciform panicle . . . . . 1. *adenophylla.*
Leaves 8–10″. Fls. in dense terminal corymbose cymes . . . 2. *denticulata.*

1. **P. adenophylla,** *Wall.*

A shrub 3–4 ft. (or up to 7 ft. in the Mals) with nearly glabrous branches. L. 4–6″ elliptic, ell.-oblong or oblong-obovate shortly suddenly acuminate, base tapering into a short ·2–·4″ long petiole, sec. n. 10–16 slightly curved strong, tertiaries obscure, gland pits in axils of many of the secondary nerves. Fls. small white ·1″ long in short pubescent rather dense cymes at intervals along the rhachis of a racemiform panicle 3–4″ long. Fruit obovoid ·2–·3″ umbonate 2-celled. Seeds, usually only 1 maturing, corrugate, ventral face flat, albumen ruminate.

Orissa, Puri District under shade from Khurda southwards! Mayurbhanj, elev. 2000 ft.! Fl. June–Aug. Fr. Dec.–Feb. Evergreen.

Under surface of leaf with microscopic white dots when fresh. Stipules half-tubular with a rounded tip due to the falling off of the acumen, deciduous and leaving a scar with ring of brown hairs. Cymules about ·25″. Pedicels very short. Calyx cup-shaped truncate or obtusely-lobed.

Distrib.: Chittagong, Sikkim, Assam and Burmah.

2. P. denticulata, *Wall.*

A stout shrub 3–5 ft. high with thick subsucculent branches, large elliptic, lanceolate or ob-lanceolate shortly acuminate leaves 8–10′ long with attenuate base and 15 to 20 nearly straight strong secondary nerves. Petiole ·8–1″. Stipules very large ·8–1″ broadly oblong and with two filiform tips ·1–2″ long, their bases connate inside the petioles, soon deciduous and then showing the brown pubescence in their axils. Fls. greenish-white ·2″ diam., salver-shaped, sub-sessile in dense terminal corymbose cymes 2–3″ diam. on peduncles 2–3″ long. Corolla tube broadly tubular ·1″ long, petals slightly longer oblong-lanceolate, throat villous.

Meghasani, Mayurbhanj, elev. 3000 ft. near rivers! Fl. May–June.

Branchlets compressed below the nodes. L. slightly puberulous on mid-rib and lower part of secondary nerves beneath, nerve pits very minute or absent. Cymes pubescent, branches opposite or 2-4 in a whorl with stalks ·5–1″ long, bracts small, (·15″) ovate or lanceolate with filiform tip. Calyx teeth small, broadly triangular. Tips of petals incurved and slightly imbricate in bud, throat villous. St. 5 erect on the throat, anthers oblong exserted. Disc large swollen. Fruit (not seen in our specimen) subglobose ·15–·2″, pyrenes plano-convex, smooth.

21. CHASALIA, *Comms.*

Corolla-tube slender curved. Seeds orbicular compressed and ventrally concave. Albumen ruminate. The rest as in *Psychotria.*

1. C. curviflora, *Thw.* Syn. C. lurida, *Miq.*

A glabrous undershrub 2–4 ft. high with pale branches, oblong or somewhat oblanceolate shortly acuminate leaves 5–10″ long with 7–11 sec. n. and petiole ·5–·8″ long. Fls. ·3–·4″ long, white, sessile in dense cymes on the rhachis of a short terminal subcorymbose panicle with a peduncle 1–2″ long. Fruit didymous sub-globose ·25″, blue.

Under dense shade and near streams. Meghasani 3000 ft., Mayurbhanj! Mals of Orissa, 2000 ft.! Fl. April–June. Fr. Aug.

Sec. n. of leaves slightly curved then running parallel to margin, tertiaries obscure. Stipules shortly broadly ovate. Panicle 1-2″ broad with short branches. Hypanthium ·07″, nerved, nerves joined round the top, sepals minute.

N.B.—I have described the Orissa form only of this species, which is very variable. *Sir J. D. Hooker* states that the flowers are dimorphic with respectively long and short stamens and style.

22. HAMILTONIA, *Roxb.*

An erect shrub, fœtid when bruised with prominently-nerved leaves and intrapetiolar acute persistent stipules. Flowers small, white or lilac, sweet-scented, capitate on the branches of broad terminal 3-chotomously branched panicled or sub-umbellate cymes. Hypanthium ovoid. Sepals 4–5 subulate, often glandular, persistent. Corolla funnel-shaped with long tube, petals 4–5 valvate. Stamens inserted in the throat, filaments short subulate, anthers obovate-oblong. Ovary 5-furrowed, almost free from the hypanthium, 5-celled,

soon 1-celled by absorption of the septa. Style filiform, arms 5 linear. Ovule 1 basal erect in each cell. Capsule 1-celled, 5-valved at the top, 5–1-seeded. Seeds 3-quetrous. Cotyledons cordate induplicate.

1. **H. suaveolens,** *Roxb.* Selauli, Sarkapi, *K.*; Buddhi Ghassi, *S.*

A shrub 4–8 ft. high, or sometimes up to 15 ft., with erect terete branches and opposite ovate, elliptic-lanceolate or -oblong acute leaves 4–9″ by 1·5–3″, hairy above, more or less pubescent beneath, with 15–20 strong sec. n. and reticulate nervules. Flowers capitate on the branches of the large panicle, with glandular-hairy bracts and bracteoles. Sepals ·1″ long with gland-tipped hairs. Corolla-tube slender, ·5–·6″ long, hairy, limb ·25″ diam.

Usually in rocky places and on northern aspects of rocky hills. Champaran, in the hills! Common on trap rocks, Santal Parganas! On Quartzite rocks in Singbhum. Ranchi, Manbhum, Hazaribagh and Palamau, ascending to top of Parasnath! Gaya ghats! Angul! Probably also in other Orissa States and districts. Fl. Aug.-Jan.

Branches glabrous (in our specimens, sometimes hispid-pubescent, *teste F.B.I.*). Petiole ·25–·75″. Stipules ·15–·2″. Panicle hairy and also sometimes with gland hairs above.

The root is used in diarrhœa and cholera. The flowers are much frequented by Humming-bird Hawk-moths.

23. PÆDERIA, *L.*

Slender twining shrubs, fœtid when bruised. Leaves with intra-petiolar triangular deciduous stipules. Flowers in axillary and terminal 2–3-chotomously branched panicled cymes. Calyx 4–5-toothed persistent. Corolla-tube tubular or funnel-shaped, pubescent, petals 4–5 valvate with inflexed crisped margins. Anthers 4–5 subsessile in the tube, linear oblong. Ovary 2-celled, stigmas 2 capillary twisted. Ovules 1, basal, erect, in each cell. Fruit compressed (in our species), epicarp thin, fragile shining, separating from 2 orbicular or oblong dorsally compressed membranous or coriaceous pyrenes. Testa aduate to the pyrene. Cotyledons large cordate thin.

1. **P. fœtida,** *L.* Gandhali, *H.*: Ghanda bhadulia, *Beng.* (both names in allusion to the smell); Golalarang, *Kharw.*

A slender climbing wiry fœtid shrub with ell.-ovate or oblong-ovate or narrow-ovate acute or acuminate leaves 2–5·5″ by ·8–3″, and nearly sessile dingy purple tubular-funnel-shaped flowers ·5″ long in axillary and terminal cymose often scorpioid panicles. Fruit ell.-ovate or oblong polished, often red, compressed, ·4″ long, with a thin fragile veined epicarp separating from the two thin ·35″-long pyrenes which have a broad wing all round.

Usually gravelly mixed forest near rivers. Purneah! Along Koil R., Palamau! Ranchi-Manbhum Ghats! Ranchi, near Pitorea, *Wood.* Fl. Aug.-Oct. Fr. Dec.

Climbing by means of the twining stems and twisted 1–3·5″ long petioles. L. glabrous with rounded or sub-cordate base, sec. n. about 7, axils sometimes hairy with glands. Panicles 4–6″ pubescent. Sepals 4–5 small obtuse or triangular, ciliolate. Petals one-fourth the length of tube, oblong with white incurved crisped margins, tube glandular-hairy within.

The leaves are boiled and made into soup, the odour disappearing. The leaves and root are considered wholesome and tonic, and the plant is used internally and externally for rheumatism, for which it is considered specific (*Nadkarni*).

24. DENTELLA, *Forst.*

Herb. Leaves small, sometimes appearing whorled from the abbreviated axillary shoots. Fls. minute inconspicuous at the forks of the branches or ends of the shoots. Hypanthium globose. Calyx at first 5-sepalous, ultimately basal portion elongating into a tube. Corolla funnel-shaped with the petals 2–3-toothed, induplicate-valvate. Fruit indehiscent 2-celled with many minute angular seeds covered with microscopic raised dots.

1. **D. repens,** *Forst.*

A small prostrate weed copiously sub-dichotomously branched with the branches 2–10″ long rooting at the nodes. Leaves membranous narrow elliptic or oblanceolate or spathulate, ·2–3″ long including the short petiole, sparsely hairy or ciliate or glabrous with scarious truncate stipules. Fls. mostly solitary, very inconspicuous, sessile, white. Hypanthium hispid, or when dry appearing fibrillous. Sepals linear ·05″. Fruit ·08″ diam., usually closely covered with fibrillæ which collect the dust, so that in the field it appears like a little ball of mud (sometimes glabrous, *teste F.B.I.*!), crowned by the persistent calyx ·07″ long.

Common along moist river beds, damp banks, rice-fields, etc. Purneah, very common! Gya! Monghyr, bed of Ganges! Chota Nagpur! Probably in all districts. Fl., Fr. Sept. and throughout c.s.

25. OPHIORRHIZA, *L.*

Herbs, rarely undershrubs with usually more or less elliptic leaves and caducous stipules. Fls. white or pink, secund on the branches of axillary or terminal 2-chotomous cymes. Hypanthium short often compressed with 5 small persistent sepals. Corolla tubular or funnel-shaped, lobes 5 short valvate, back often winged. Stamens 5 on the tube, anthers linear. Disc large 2-lobed. Ovary 2-celled, style filiform, ovules many on basal ascending placentæ. Capsule coriaceous compressed, produced above the hypanthium, dehiscing at the top with broad gaping valves. Seeds many minute angled. Embryo clavate.

Leaves lanceolate. Fl. ·2–·3″ long. Fr. ·25–·3″ broad . . . 1. *Harrisiana.*
L. ell. or oblanceolate. Fl. ·5–·75″ long. Fr. ·4″ . . . . 2. *fasciculata.*

1. **O. Harrisiana,** *Heyne.*

A succulent herb 1–1·5 ft. high erect from a creeping root with lanceolate satiny leaves 2·5–4″ long, puberulous on the nerves beneath. White flowers ·2–·3″ long, hispidulous, ribbed, on the 3–5 erecto-patent stout fleshy branches of the cymes, which elongate to 2 or 2·5″ in fruit and bear the curious transversely compressed fruits ·25–·3″ broad along the inner face. Bracts on the cyme 0.

Near streams under the shade of trees, Baruni Hill forest, Puri! Fl., Fr. September.

L. acuminate both ends with about 12 close-set secondary nerves depressed above. Stipules with a long filiform tip. Cymes minutely pubescent. Fruit hispidulous-pubescent.

Note.—The above description is entirely from my notes on the fresh specimens, which I have been unable to compare as they were lost in camp. The pubescent capsules would bring it under *O. trichocarpa*, Bl., but *O. trichocarpa* is altogether more pubescent than the Puri plant.

2. **O. fasciculata,** *Don.*

An erect sub-succulent weak herb about a foot high ascending from a creeping root with pubescent stems, elliptic or somewhat ovate or oblanceolate leaves 3–6″, somewhat pale and glistening when fresh,

membranous when dry, and slender-tubed white flowers ·5–·75 long on the branches of a corymbose pubescent cyme which has a long peduncle and long tapering linear persistent bracts on the branches. Capsule compressed ·4″ broad, side lobes almost wing-like.

On moist shady banks and ravines under trees. Neterhat 3000 ft.! Fl. May–Sept. Fr. Aug.–Oct.

L. thinly pubescent on the nerves beneath, somewhat acuminate and base tapering into the ·5–1·5″ long petiole. Sec. n. slightly arched, strong, about 12. Stipules lanceolate and with a long filiform tip. Peduncle 2–3″. Cyme branches ·5–·75″ pubescent. Bracts ·25–·4″. Hypanthium much compressed with very short sepals only reaching the top of the disc. Seeds many minute brown tetrahedral.

Distrib.: Sub-tropical Himalaya and Khasia Hills.

26. HEDYOTIS, *L.*

Shrubs, undershrubs or herbs. Leaves occasionally ternately whorled, with usually conspicuous stipules furnished with bristles, sometimes combined into a sheath. Fls. white or lilac, in axillary clusters or capitate cymes, more rarely in lax axillary or terminal cyme. Sepals 4, acute, persistent, their bases usually broad or adjacent to one another (*cp. Oldenlandia*). Corolla funnel- or bell-shaped, lobes 4, valvate. St. 4 in the tube or throat. Ovary with filiform style and 2-fid or 2-lobed stigma, ovules numerous on axile placentæ. Fruit small, indehiscent or capsular or of 2 cocci. Seeds plano-convex or angled. Embryo clavate.

Some authors now unite *Hedyotis* and *Oldenlandia*. The more or less shrubby species are distinguished by this habit, but some of the herbaceous species are only separable by the more dilated stipules and the wider base of the sepals, which characters are only relative and not always evident. Both genera being large, and to avoid multiplication of synonyms, however, I prefer to keep them distinct as is done in the *F.B.I.*, merely indicating the intermediate species.

I. Climbing shrub with fls. in large terminal cymes . . . . . 1. *scandens*.
II. Herb with slender rhizomes. Cymes axillary lax. Fr. indehiscent 2. *vestita*.
III. Annual herbs. Capsule dehiscent loculicidal on top.
Leaves ·2–·6″ broad. Fruiting-calyx ·2–·25″ . . . . . 3. *hispida*.
Leaves under ·1″ broad. Fruiting calyx ·12–·14″ . . . . 4. *pinifolia*.

1. H. scandens, *Roxb.* Syn. Oldenlandia scandens, *K. Schuan.*

A large scrambling shrub with green terete smooth branches thickened at the nodes, opposite lanceolate or elliptic acuminate leaves 2·5–4″, pale and nerveless beneath and dense corymbose cymes of small white sweet-scented 4–5-merous flowers. Fruit sub-globose ·12–·15″ long with top of capsule loculicidal produced above rim of hypanthium and sometimes exceeding the sepals.

Riverain jungles, Purneah! Fl. Sept.–Jan. Fr. Dec.–Feb.

L. glabrous, sometimes caudate, base narrowed, sec. n. very obscure but slightly raised above. Petiole ·15–·4″ connected by broad stipules which have a short acumen or are 2-cuspidate when young. Corymbs about 1″ diam. puberulous, sometimes shortly panicled. Hypanthium ·1″ produced above the ovary in flower, sepals distant linear-subulate. Corolla-tube very short about one-fourth as long as the linear-oblong ·22″ long petals which are villous at base within. Filaments flattened villous within, shorter than petals. Style hairy, stigmas oblong.

2. H. vestita, *Br.*

A diffuse herb from a slender twisted nodose tuberous rootstock with pubescent hirsute or sub-villous branches, narrowly elliptic or oblong soft pubescent leaves 1·5–3″ by ·5–1″ and small flowers in axillary short 3–5-nate slender cymes on peduncles ·12–·3″ long, once

or twice 2–3-chotomously branched. Fruit very small indehiscent, hispid, ·05″ diam.

Singbhum, in Sal forest in the valleys, rare! My specimens are in fruit only. Fl. Aug.–Sept. Fr. Nov.–Jan. Perennial.

Leaves hairy both sides, acute both ends, scarcely acuminate, base narrowed subsessile or shortly petioled, sec. n. 4, very oblique, raised beneath. Stipules connate below, short, but with a setaceous hairy acumen ·12–·2″ long. Cymes hispid-hairy ·25–·5″, 3-10-fld., bracts linear ·08–·12″ long. Pedicels very short. Calyx with hypanthium hispid, ·08–·1″ long with the sepals rather exceeding the tube, contiguous or connate at base, linear or narrowly triangular 1-nerved acute.

The usual Deccan form is *H. auriculata*, *L.*, distinguishable by the less hairiness and the capitate cymes, but this has hitherto not been recorded from our area.

3. **H. hispida,** *Retz.* Syn. Oldenlandia hispida, *Benth.*

A diffuse herb with stems 8–15″ long, branches hispidulous terete or somewhat compressed with two raised stipular lines each side, sometimes grooved between these lines. Leaves lanceolate or linear-lanceolate, 1·25–3″ long, nerveless (exc. mid-rib), pale beneath, hispid beneath and on the margins. Stipules with linear-subulate appendages ·15–·3″ long. Flowers clustered axillary sometimes numerous in heads ·7″ across, calyx densely hispid, ·25″ long in fruit (including hyp.), the tube shortly tubular above the hypanthium with lanceolate sub-aristate lobes. Fruit crustaceous, ·09″ diam. and about ·1″ long, loculicidally 2-valved from the top. Seeds many angular.

Very common in Chota Nagpur! Usually in poor open forest land on clay soil. Fl. r.s. Fr. Nov.–Jan.

Root sometimes woody. Leaves seldom hispid on the upper surface except at the margins, trabeculate when dry, sessile or subsessile, margins sometimes recurved, thickened.

4. **H. pinifolia,** *H.f. ex Wall. Cat.*

A much more slender and wiry plant than the last with the stipular lines on the branches usually making them acutely 4-angled and with the slender leaves subacicular ·5–1·5″ long, often fascicled, scabrid, nerveless except the mid-rib, margins revolute, tips very acute or pungent. Stipules about 1·5″ including the long bristles. Cymes usually fewer-fld. Fls. similar but smaller, only ·12–·14″ long *in fruit*, sub-sessile or shortly pedicelled, hispid, lanceolate teeth only half as long as the rest of the fruit. Corolla only ·1″ long including the petals. Top of capsule free 2-lobed (as in last but more so), keeled, seeds many small brown, 3-angled.

Common on fire-lines, etc., in the forests of Chota Nagpur, chiefly on clay soil and over 1000 ft.! Gya hills! Fl. r.s. Fr. Nov.–Dec.

27. OLDENLANDIA, *L.*

Slender, erect or diffuse, often 2–3-chotomously branched herbs with the leaves generally small and narrow and stipules often scarious and bristly. Fls. small, mostly white or pinkish, on 1–4-fld. axillary peduncles or in terminal panicled cymes, rarely subsessile. Hypanthium not or slightly produced above the ovary with 4 very small sepals, usually erect and distant in fruit, sometimes with alternating smaller teeth. Corolla funnel- or salver-shaped with long or short tube, petals 4, rarely 5, valvate. Ovary 2-celled, stigmas 2-linear. Ovules numerous. Capsule small with the crown sometimes projecting above the hypanthium, loculicidal at the top or to the base. Seeds angled or rounded, smooth or pitted. Embryo clavate in fleshy albumen.

Hedyotis is well united with this genus in the *Flora of Madras*; the species with broad-based sepals adjacent in fruit (*e.g. crystallina*) are scarcely distinguishable. The older name is *Oldenlandia*.

† Leaves narrow, sometimes grass-like. Seeds angled, smooth.
I. Corolla-tube short or only slightly exceeding the sepals.
A. Peduncles axillary from the lower or all the axils, not in leafless panicles.
1. Diffuse or sub-erect.
Sepals triangular-subulate distant. Pedicels long slender, usually paired on a slender peduncle. L. not acicular . . . . . 1. *corymbosa*.
Hispidulous. L. sub-acicular. Peduncle often 0 or short. Pedicels often 2–4-nate . . . . 2. *scabrida*.
Glabrous. Pedicels solitary, very short, often not exceeding flower or 0 . . . . . 3. *diffusa*.
Sepals broadly lanceolate, contiguous. Fls. 1–2 from all the axils. Small prostrate herb . . 4. *crystallina*.
2. Erect, corymbosely branched. Pedicel slender solitary axillary. Sepals very short, distant . 5. *herbacea*.
B. Peduncles mostly from the upper axils, several-fld., sometimes cymose but not in open terminal cymes or panicles.
Pubescent. L. ·2–·5″. Stipules with bristles. Sep. nearly as long as corolla. Capsule ·05–·06″ . . 6. *umbellata*.
Rigid nearly glabrous. Stipules muticous. L. ·3–·9″, sepals half as long as corolla. Capsule up to ·15″ . 7. *arenaria*.
C. Peduncles from the upper axils and in terminal leafless lax cymose panicles.
Branches acutely 4-angled . . . . . 8. *brachiata*.
II. Corolla-tube long, far longer than the sepals.
A. Whole plant divaricately branched ending in dichotomous cymes with very slender peduncles . . . 9. *dichotoma*.
B. Plant strict or only branched above.
Fls. ·2″ long. Capsule ·12″ long and broad . . . 10. *nagpurensis*.
Fls. ·6″ long. Capsule ·16″ long, oblong . . . 11. *gracilis*.
†† Leaves elliptic or ovate, rarely oblong, over ·25″ broad. Seeds subglobose, pitted.
Branched from the base. L. not sub-verticillate . . . 12. *paniculata*.
Sub-simple, short with one pair of leaves below and a sub-verticil above . . . . . 13. *nudicaulis*.

1. O. corymbosa, *L.*

A branching diffuse slender glabrous or minutely hispidulous annual with linear, linear-lanceolate or narrowly elliptic-lanc. leaves ·5–2″ long without visible sec. n. Flowers minute white paired, more rarely only 1 or 3–4 on the axillary peduncles which are longer or shorter than the very slender ·1–·5″ long pedicels. Sepals subulate ·04–·05″ long. Corolla-tube slightly exceeding the sepals. Capsule ·08–·1″ long and broad, not projecting beyond the hypanthium.

A common weed, usually in rather moist places, dried rice-fields, moist paths, etc., ascending to the tops of the pats in Chota Nagpur! Probably in all districts. Fl., Fr. June–Jan.

Very variable with branches from 2″ to 1 ft., leaf margins recurved, stipules short membranous with 2–3 long fine teeth and often smaller intermediate ones. Corolla about ·09″ long including the petals.

The next species is practically a well-marked variety of this which I keep distinct because *O. diffusa* is usually kept distinct although it differs quite as little.

2. O. scabrida, *DC.* Syn. O. corymbosa, *F.B.I.* (in part).

A sub-erect much-branched slender herb 5–9″ high with 4-angled scabrellous or hispidulous stems and very narrowly linear or sub-acicular leaves ·5–1·5″ long with the margins recurved scabrellous

or hispidulous and ending in a pungent tip, not unlike those of *Hedyotis pinifolia*. Stipules scarious ·07–·1″ including the 1–4 slender appendages or bristles. Peduncles mostly solitary axillary and 1-fld. but sometimes 2-nate or 3–4-fld. with a minute slender bract at the fork. Ped. and pedicels filiform. Sepals narrowly lanceolate, slightly shorter than the corolla-tube, margins hispidulous. Fruiting calyx ·12–·13″ long with the teeth rather shorter than the hypanthium, the latter slightly hispidulous or glabrescent. Capsule slightly projecting above the hypanthium. Seeds broadly oblong angled.

Lohardagga, *Gamble*! Singbhum!

3. **O. diffusa,** *Roxb.*

Scarcely more than a variety of *O. corymbosa*, very diffuse, distinguished by the flowers being solitary and sessile or with peduncles scarcely exceeding the length of the flower. Glabrous, with narrowly lanceolate or linear leaves.

Wet ground, Purneah! Probably common. Fl. r.s.

4. **O. crystallina,** *Roxb.*

A small diffuse flaccid glabrous annual or the well-marked stem ridges and leaves slightly hispidulous, branches 2–4″ long, L. ell. or lanc., ·25–·6″, minutely dotted. Peduncles 1–2-fld.; if 1-fld. then shorter than the leaves. It differs from the preceding especially in the broader leaves and the broadly lanc., sometimes hispid, sepals ·07″ long, the bases of which nearly touch even in fruit (as in *Hedyotis*) and which are nearly as long as the corolla. Hyp. in fruit strongly 4-nerved or -ribbed.

Garden paths, etc.! Fl., Fr. Jan.–March.

Stem often minutely hirtellous. Fls. ·09″ sometimes 5-merous. Petals ovate. Seeds rounded oblong minutely pitted.

5. **O. herbacea,** *Roxb.* Syn. O. Heyneii, *F.B.I.*

An erect much corymbosely branched herb 1–2 ft. high with lower leaves linear-lanceolate tapering both ends, very acute, about 1″, upper smaller linear. Stipules 0, obscure or with minute teeth. Fls. very numerous, solitary in the axils of all but the lowest leaves, on very slender peduncles ·25–·75″ (rarely 1″) long. Top of capsule ridged projecting above the hypanthium and reaching to about the level of or beyond the top of the sepals. Seeds minute black or brown, ellipsoid 3-angled.

Not recorded from the Northern Tract, but from Chota Nagpur southwards it is fairly common in open jungles and waste ground. Ranchi! Hazaribagh, *Gamble*! Manbhum, *Clarke, Gamble*! Puri! Sambalpur! Fl., Fr. Sept.–Jan.

Quite glabrous, even the 4 raised lines or angles on the stems. Corolla ·1–·15″ long, several times longer than the very small subulate sepals. Fr. nearly globose or very slightly didymous, ·1″.

The entire plant is used in medicine and is regarded as a bitter tonic and febrifuge.

6. **O. umbellata,** *L.*

A diffuse annual with branches 2–6″ long, stems rather woody, about 6–8-ridged or -lined, hispidulous (sometimes glabrous, *F.B.I.*).

L. ·2–·5″ (in our area). Fls. minute white in 3–7-fld. umbels at the ends of the branches and also sometimes axillary. Capsule very small ·05–·06″.

On sand dunes on the Orissa coast! Fl., Fr. Sept.–March.

L. often clustered with recurved margins. Stipules with several bristles. Sepals narrow lanceolate nearly as long as capsule and not much shorter than the corolla-tube. Crown of capsule only reaching the top of the hypanthium. Seeds shortly oblong, obscurely angled.

7. **O. arenaria,** *Haines* (*Journ. As. Soc. Beng.* xv, No. 7).

A herb glabrous or nearly so with many diffuse striate stiff branches 4–8″ long, linear sessile leaves ·3–·9″ long with recurved margins connected at base by membranous truncate stipules without bristles. Fls. minute on short stout pedicels about as long as themselves in dense terminal umbels. Sepals lanceolate minute about half as long as the corolla tube. Corolla funnel-shaped. Capsule broadly-oblong, not didymous, ·12″–·15″ long (3–3·7 mm.), top slightly raised above the hypanthium but not as long as the sepals. Seeds pale brown, ellipsoid, obscurely angled.

Sands of Orissa coast. Fl., Fr. Aug-Oct.

8. **O. brachiata,** *Wight.*

A very slender erect annual 3–8″ high with acutely 4–6-angled glabrous stem and linear or almost filiform leaves ·5–1·3″ long. Flowers minute on capillary pedicels in elongate lax terminal cymes and sometimes also a few axillary. Sepals minute distant subulate. Crown of capsule slightly raised above the hypanthium.

Patna, *Hamilton*! This is so far the only record from our area.

9. **O. dichotoma,** *Koen.*

A very slender copiously paniculately branched annual 8–18″ high, branches terete with 2 raised hispidulous lines each side, the ultimate ones filiform. L. linear to linear-lanc. or narrowly lanceolate, 1–2″, sec. n. scarcely visible. Fls. very minute bluish ·15″ diam. solitary on long filiform pedicels, or 2-nate on axillary peduncles and in terminal capillary panicles: peduncles and pedicels ·4–1·3″ long.

Frequent in Chota Nagpur in open places or on rocks. Kuru (Ranchi), *Gamble*! Hazaribagh, *Clarke*! Manbhum, *Clarke*! Behar, *Kurz*! Neterhat! Fl., Fr. Aug.–March.

It is closely allied to the last, and *Wallich's* type sheet (6204) shows the slender stems with 4 raised hispidulous lines. Sepals very minute subulate about half as long as corolla tube, sometimes hispidulous. Capsule not exceeding the hyp., only ·06″, often splitting with the hyp. to the base. Seeds about 20 (cells about 6-seeded, *J.D.H.*), globose-oblong, granulate.

10. **O. nagporensis,** *Brace.* Syn. O. senegalensis, *Hiern* (*F.B.I.*).

A very slender annual with linear leaves 1–2·2″ long and wiry stem terminating in a wide spreading very lax cymose panicle. Cyme-branches divaricate, pedicels capillary 1–2″ long, flowers minute, pink, sepals subulate, much shorter than the slender corolla-tube, which is ·08–·12″ long only, petals acuminate. Capsules ·15″ long and broad.

Hazaribagh, *Clarke*! Singbhum! Fl. Sept.-Oct. Fr. Nov.

Leaves acuminate, margins flat or recurved.

11. **O. gracillis,** *DC.*

A slender, almost grass-like herb, with sparingly branched stem 8–18″ high, erect linear-acuminate glabrous flat grass-like leaves 1·5–3·5″ long, and narrow panicles of erect pale-brown or lurid green-purple flowers very easily recognised by the corolla, ·3–·5″ long on very long slender pedicels. Capsules ·17–·25″.

Open grassy places, noticeable especially after grass fires. Champaran! Purneah! Plateau and Pats of Chota Nagpur (Hazaribagh, Manbhum, Neterhat etc.)! Fl., Fr. Feb.–June.
A very distinct species.

12. **O. paniculata,** *L.*

A more leafy and usually stouter species than any of the preceding, much branched from the base with stems 6–18″ long obtusely 4-angled. L. elliptic to broadly elliptic, acute or obtuse, ·5–2″ long and often ·5″ broad, sec. n. scarcely visible, base narrowed into a petiole. Fls. in axillary and terminal cymes which are only 2-fld. in impoverished plants but up to 10-fld. in luxuriant ones. Sepals very small deltoid. Corolla-tube short. Capsule ·1″ and often broader, top usually ridged and projecting beyond the sepals. Seeds subglobose, pitted.

Northern tract: Darbhanga! Southern tract: Puri district (Balugaon) *Hooper*! Fl., Fr. apparently throughout the year.
Stipules with only two median bristles.

13. **O. nudicaulis,** *Roth.*

A small herb 1–6″ high with either two pairs of leaves or a lower small pair and two pairs above which are sometimes separated by such a short internode as to appear whorled. Stem furfuraceous or with thick hairs below, naked towards the panicle. Leaves broadly elliptic or ovate, the larger 1–2″ long, flaccid, pubescent on the nerves beneath and ciliate. Flowers small, white, with slender pedicels in long stalked dichotomous cymes often bearing a pair of bract-leaves at the first fork. Calyx-teeth slender nearly as long as the tube in flower, widely separate and minute in fruit. Corolla lobes valvate rotate, oblong, ·06–·08″, tube very short, throat villous. Capsule compressed, ·1″ diam., loculicidally dehiscent at the top. Seeds dark brown, slightly pitted, obscurely angled.

Frequent in waste ground, open forest, etc. Chota Nagpur! Fl., Fr. Aug.–Oct.
Stems rarely branched with each branch bearing a whorl of leaves. L. with 4–5 distinct oblique sec. n., apex rounded. Cymes 2–4″ long, one from each of the axils of the first pair of larger leaves and three terminal.

28. ANOTIS, *DC.*

Prostrate or ascending rarely erect herbs with stipules like those of *Oldenlandia*. Flowers in cymes. Hyp. short, sepals usually distant, 4. Cor. tubular or funnel-shaped, lobes 4, shorter than tube, valvate. Ovary 2- rarely 3–4-celled, ovules few in each cell on placentæ ascending from near the base of the septum. Capsule didymous or laterally compressed, loculicidally 2-valved at the top, cells 1–few-seeded. Seeds peltate, boat-shaped or plano-convex, coarsely pitted. Embryo clavate.

1. **A. calycina,** *Wall.*

A glabrous or minutely hairy herb 4–10″ high, erect from a creeping base with lanceolate to ovate-lanceolate sub-acuminate ciliolate leaves ·5–2″ long. Stipules short and broad with bristles. Flowers sessile and on slender pedicels, very small, lilac, in very divaricate dichasial cymes 2–3″ long. Corolla ·15″ long with very slender tube. Capsule ·13″ broad didymous, widest above, base rather tapering. Seeds brown-black peltate pitted on the convex side.

Parasnath, near the top, several times collected, but I have seen it nowhere else in the province. Fl., r.s. Fr. Oct.–Nov.

29. SPERMACOCE, *L.* (inc. Borreria).

Herbs or low undershrubs with usually square branches; often with the habit of *Hedyotis*. Leaves opp. or sub-verticillate with their stipules connate with the petioles into a broad truncate tube with marginal bristles. Fls. small or minute, solitary or in axillary or terminal fascicles or cymes. Calyx-tube (above the hypanthium) hardly any, sepals usually small, sometimes two smaller or absent, sometimes interposed teeth or bristles present. Cor. funnel- or salver-shaped with 4 valvate lobes. St. 4 on throat or tube often exserted. Ovary 2-celled, style filiform with two short arms or capitate stigmas. Ovule 1 in each cell on the middle of the septum. Capsule dehiscing septicidally or septifragally into two valves or mericarps, and each mericarp loculicidal from the top, or septum sometimes adnate to and closing one mericarp. Seed oblong, ventrally grooved. Cotyledons very thin. Radicle inferior.

Note.—*Meyer* makes three genera out of the dehiscence of the capsule, of which two concern us, *Spermacoce* and *Borreria* (*Meyer*). In *Spermacoce* he says the capsule is not bipartite, one valve dehisces, the other remains closed by the septum formed out of the lamellæ belonging to both valves. To this genus he assigns *S. hispida*. In *Borreria* the capsules are 2-partite, the septa are incomplete, being inflexed at the margins of the valves which are more or less open ventrally. To this belongs our species *stricta*. The *F.B.I.* also states that one mericarp remains closed by the septum in *S. hispida*. This however is not invariable and I have met fruits in which the septum stands quite free between the two open mericarps!

L. much longer than broad. Corolla under ·15″. Capsule (see above) under ·1″ . . . . . 1. *stricta.*
L. rarely three times longer than broad. Cor. over ·3″. Capsule (see above) over ·1″ . . . . . 2. *hispida.*

1. **S. stricta,** *L.f.* Syn. Borreria stricta, *Meyer.*

A more or less erect much branched herb 6–18″ high with linear-oblong or linear to oblong-lanceolate leaves ·8–2″ long, scabrid-hispid above and on the very oblique nerves beneath, acute or acuminate, sub-sessile, base hispid. Flowers few or many in dense axillary and terminal clusters. Hypanthium pubescent above ·06″. Sepals 4 with often 2 additional bristles, narrowly linear, spinulose tipped but not hispid, ·07–·06″ long. Corolla white salver-shaped or somewhat funnel-shaped, ·09–·12″ long including the ovate-triangular petals. Filaments slender. Fruit sub-muricate or hispid-scabrid above, ·08″ long, septicidal, each valve carrying part of the septum near its margins but open in the centre, also loculicidal above. Seed free in the partially open capsule, ellipsoid, deep brown, highly polished.

A common weed in waste lands and open places in the forests in most or all districts! Fl. r.s. Fr. Oct.–Dec. Annual.

The stems have usually two narrow wings and are very sparsely shortly hispid; sometimes there are two additional equally strong or weaker wings or lines, making it 4-angled.

2. **S. hispida,** *L.*

A procumbent scabrid or hispid herb much branched from the root with rather distant pairs of obovate oblong or elliptic leaves ·4–1″ long, usually obtuse or rounded, more or less scabrid both sides. Flowers clustered pale lilac or white with tubes ·37–·5″ long slightly dilated upwards. Hyp. narrow ellipsoid, ·08″. Sepals ·05–·06″ hispid, two usually stouter than the others. Petals short obtuse. Capsule ·11–·12″ long, septifragal, the thin septum being left entire between the concave oblong loculicidal valves which are entirely open ventrally. Seed brown, polished, microscopically tessellate.

A very common weed in open wastelands and pastures. Fl. July–Oct. Fr. Sept.–Dec.

Stems usually with 4 acute angles or ridges sparingly scabrid below, hispid above. Bristles on the stipules long in both species.

30. HYDROPHYLAX, *L.f.*

Creeping glabrous succulent littoral herbs with sessile ovate-oblong leaves and stipules united with the petioles into an entire or toothed cup. Flowers solitary, axillary, shortly pedicelled, rose or lilac, 4-merous. Hypanthium 4-angled. Sepals ovate-lanceolate, persistent. Corolla rather fleshy, between bell- and funnel-shaped, with a ring of hairs within; petals 4 ovate, valvate. Stamens on the throat, filaments filiform, anthers linear. Ovary 2-celled, style filiform, pubescent, stigma obscurely 2-lobed. Ovules 1 in each cell, peltately attached to the septum. Fruit large, corky, oblong-ovoid, compressed, curved, acutely 3–4-keeled between the acute margins, 2-seeded.

1. **H. maritima,** *L.f.*

Stems creeping several feet, scarcely branched. Leaves very fleshy ·5–1″ by ·25–·5″, mostly obovate acute, sometimes papillose. Flowers pretty, gentian-like, ·3–·5″ diam. with a tube ·3–·5″ long and 4 spreading lobes. Fruit ·5–·7″ long crowned with the enlarged sepals.

Sandy sea shores of the Orissa coast, Puri! Fl. June.

The plant is a sand-binder, but is not of great use in this respect owing to its being so little branched and the roots given off at the nodes are of no great length.

31. KNOXIA, *L.*

Erect herbs or undershrubs, stems often grooved, with two lines of pubescence. L. opp., stipules connate with the petiole into a sheath. Fls. dimorphous, pink or lilac, small, subsessile on the elongating branches of terminal cymes. Calyx teeth minute or 1-2 elongate, persistent. Corolla tubular-funnel-shaped, throat villous, lobes 4 valvate with inflexed tips in bud. St. 4 in the tube. Ovary 2-celled, style filiform, stigma 2-lobed. Ovule 1 pendulous in each cell. Fruit very small, of two connate or separating indehiscent mericarps

falling away from or with the columella. Seeds with thickened funicle. Embryo axile, cotyledons thin.

Leaves petioled acute. Mericarps united . . . . . 1. *corymbosa.*
Leaves sessile obtuse. Mericarps separating . . . . . 2. *brachycarpa.*

1. **K. corymbosa,** *Willd.* Syn. Spermacoce teres and S. exserta, *F.I.*

An erect sparingly branched slender annual 1–4 ft. high with pubescent or tomentose stems, long narrow acuminate leaves 3–5″ long and terminal corymbosely branched cymes with the minute white or purplish flowers sub-spicately arranged on its branches. The somewhat compressed and ridged fruit is ·07–·09″ long and falls away from the central persistent filiform columella leaving a minute perforation through its axis; the mericarps remain united. Seeds black, flat on one face and keeled on the other.

Common throughout the province in grass lands and also under shade. Fl., Fr. Aug.–Dec.
Stem with long internodes, 3-chotomously branched above, hairs crisped. L. tapering both ends more or less pubescent, with 6–10 slender oblique sec. n. Spiciform branches of cyme ·25–1″ long. Corolla about ·06–·08″ long. Stamens included.

2. **K. brachycarpa,** *Bl.* Syn. Spermacoce lævis, *F.I.*

A herb of similar habit to the last. Stems often grooved and with two lines only of pubescence on the rounded faces. Leaves oblong 2–4″ with obtuse or rounded tip and usually obtuse base, sessile. Flowers lilac, very shortly pedicelled, about ·18″ long including the ovary. Mericarps oblong, ·08″ long, plano-convex, separating and falling separately from the persistent filiform columella.

Top of Parasnath, *C. B. Clarke*! Fl., Fr. Oct.
Stems sometimes hairy, *F.B.I.* Leaves erect hairy on the nerves, sec. n. 8–10 very oblique. Corolla ·12–·13″ with obtuse lobes.

32. RUBIA, *L.*

Scabrid or prickly erect diffuse or climbing herbs with whorled leaves. Flowers small or minute, in axillary and terminal cymes, pedicels jointed with the flower. Hypanthium ovoid or globose. Calyx 0. Corolla rotate or shortly bell- or funnel-shaped, lobes 4–6 valvate. Stamens 4–6 on the tube, anthers globose or oblong, exserted. Ovary 2-celled, style 2-fid or styles 2, stigma capitate. Ovules 1 erect in each cell attached to the septum. Fruit small didymous, or globose by the suppression of one carpel, indehiscent, often fleshy. Seeds adhering to the pericarp, cotyledons broad thin, radicle slender inferior.

Leaves ovate-cordate, 4 in a whorl, petioled . . . . . 1. *cordifolia.*
Leaves sub-acicular, 4–8 in a whorl, sessile . . . . . 2. *angustissima.*

1. **R. cordifolia,** *L.* Manjit, *H.*; Jata Singhi, *Birja*; Madder.

A herb scrambling over bushes by means of its scabrid or minutely aculeate stems, petioles and whorled leaves. Leaves ovate-cordate acuminate or, in our area, usually ovate-lanceolate with rounded or cordate base, 2–3″ long with 5–7 principal nerves, scabrid above, hairy beneath. Petiole 1–3″ aculeate with small hooked prickles.

Flowers yellowish-white ·1″ diam. umbellate on the branches of 3-chotomous cymes 1–3″ long. Corolla hispid with 5–6 recurved petals. Fruit globose fleshy ·12–·17″ diam. or didymous.

Higher Mts. of the Central Area. Neterhat, 3000 ft.! Parasnath 4000 ft.! Fl., Fr. Oct.–Jan.

The root gives a dye (madder) and is also used in Indian Medicine. The plant is very variable and only the local form is described above.

2. **R. angustissima,** *Wall.*

A weak very scabrid branched scrambler superficially resembling an Asparagus with ridged branches and numerous close whorls of linear-acicular leaves 1–1·8″ long. Fls. very small cream-coloured, at the ends of axillary ribbed pedicels or on two-bracteate peduncles or (*f. F.B.I.*) in 3–5-fld. cymes on the peduncle. Fruit globose ·2″.

Sandstone Hills of N. Champaran! Fl., Fr. Nov.–Jan.

Stems polished. L. mostly 8 in a whorl, ·05–·08″ broad, scabrid with strong midrib beneath, flat or grooved above. Pedicels shorter or longer than the subtending leaves. Corolla subglobose ·05″ with 5 lanceolate petals much longer than the very short tube.

FAM. 78. COMPOSITÆ.

Shrubs or usually herbs, very rarely trees. L. alternate or sometimes opposite, usually simple without stipules, base of leaf or petiole sometimes sheathing. Flowers (florets) sessile in a dense head on a common receptacle, each head surrounded by a calyx-like involucre of bracts (connate into a 2-celled utricle in *Xanthium*) and resembling a single flower, heads with their respective involucres sometimes again combined into heads of a higher order (compound heads) and then sometimes reduced to a single flower each. Florets all alike in sex (homogamous) and similar in form, or dissimilar in sex (heterogamous) or in form; when dissimilar the outer florets are either 1- or several-seriate and more slender than the inner or furnished with a strap-shaped or linear appendage (ligule) to the corolla, when ligulate the outer florets constitute the *ray-* (heads radiate) and the inner florets constitute the *disc*-fls. Calyx superior, reduced to scales, hairs or 0, and in fruit constituting the *pappus*. Corolla tubular or somewhat funnel-shaped, 2–5-toothed or cleft or ligulate or somewhat bilabiate. Stamens 5 (rarely 4) inserted in the corolla tube, anthers usually connate in a tube, pollen spinulose or verrucose. Ovary inferior 1-celled with 1 basal anatropous ovule with one integument. Style 2-fid. or arms connate in barren florets, furnished with a pubescence or hairiness (brush-hairs) distinct from the stigmatic lines or areas. Fruit (cypsele) dry indehiscent, closely investing the exalbuminous seed, which has a very thin testa, pappus sometimes caducous or 0. Embryo straight, cotyledons plano-convex, radicle short.

Note.—The structure of the style is important in classification but is a difficult field character. The character of tailed or ecaudate anthers is also important and this is nearly as difficult, not being easily seen in the field. In addition therefore to the usual classification based on the *Genera Plantarum* an artificial key is appended in which the above characters are as far as possible eliminated. The distinction between a few genera (*e.g. Conyza Blumea*) is, however, wholly dependent on

them. The brush-hairs have apparently the function of sweeping out the pollen from the ripe (proterandrous) anthers as the style is thrust up through the staminal tube.

I. **Tubulifloræ.** Inner or disc florets never ligulate. Juice not milky (*vide* p. 456) :—

A. Style neither with a thickening nor with a corona of hairs at or just below the bifurcation (*vide* p. 456) :—

Tribe I. Vernonieæ. Heads with the fls. all similar and tubular, homogamous never yellow. Leaves alt. Anthers cleft at base. Style with long semi-terete acuminate arms stigmatic on their inner surfaces, with brush-hairs on their outer surfaces and extending to below the fork.

Heads simple. Stems leafy . . . . . 1. *Vernonia.*
Heads compound. Leaves chiefly radical. . . . 2. *Elephantopus.*

Tribe II. Eupatorieæ. Heads with fls. similar and tubular, never yellow. Anthers sub-entire at base. Style arms not acuminate, stigmatic areas narrow marginal often short, brush-hairs short blunt above the stigmatic lines and never extending to the fork.

1. Anther tip truncate . . . . . 3. *Adenostemma.*
2. Anther tip appendiculate :—
Pappus paleaceous . . . . . 4. *Ageratum.*
Pappus of slender hairs. Invol. bracts 4 . . . . 4.* *Mikania.*

Tribe III. Astereæ. Hds. homogamous or heterogamous, fls. similar and tubular or dissimilar. Anthers ecaudate. Style-arms more or less flattened bearing the stigmatic surface in two conspicuous marginal lines, above which is a short or elongated more or less conical tip with brush-hairs or -papillæ.

1. Heads radiate, ligules never yellow. Inner pappus of long hairs :—
Ligules very narrow 2-3-seriate. Pappus-hairs subsimilar . . . . . 5. *Erigeron.*
Ligules broader 1-seriate. Pappus-hairs sub-similar . 5*. *Aster.*
Inner pappus of hairs, outer a ciliate corona . . . 5**. *Callistephus.*
2. Heads not radiate but outer fls. filiform :—
a. Pappus 0 or minute. L. pinnatisect or pinnatifid :—
Erect odorous herb. Hds. purple, panicled . . 6. *Cyathocline.*
Prostrate villous herb. Hds. yellowish, solitary . 7. *Grangea.*
b. Pappus long. Erect leafy herbs . . . . . 8. *Conyza.*

Tribe IV. Inuleæ. Hds. heterogamous with fls. dissimilar or 1-fld. and compound. Receptacle not paleaceous (exc. *Athroisma*). Anther-cells caudate (exc. *Laggera* and non-polleniferous anthers). Style arms sometimes resembling those of Vernonieæ, sometimes truncate or typically (style of Inulineæ) with obtuse or rounded tips with the stigmatic lines marginal meeting over the top and short brush-hairs only towards the tip.

1. Style nearly that of Vernonieæ (or entire in sterile fls.), bracts not scarious, rarely sub-scarious. Hds. not radiate ; outer fls. usually filiform :—
a. Hds. simple (though sometimes clustered, not on a common receptacle) :—
i. Pappus copious. Herbs :—
Anther-cells ecaudate. Florets purple . . . 9. *Laggera.*
Anther-cells caudate (exc. as above) . . . 10. *Blumea.*
ii. Pappus copious. Shrub . . . . . 11. *Pluchea.*
iii. Pappus 0 or 2-3 caducous hairs only . . . 12. *Epaltes.*
b. Hds. compound. Pappus 0 . . . . . 13. *Sphæranthus.*
2. Bracts scarious or hyaline. Style arms usually obtuse or truncate. Hds. often clustered, not radiate :—
Leaves pinnatifid. Recep. with pales enclosing the fls. 14. *Athroisma.*
L. simple. Cottony herbs. Pappus 0 . . . . 15. *Gnaphalium.*
L. simple. Glabrous herb with 1-fld. hds. compound in a leafy involucre. Pappus 0 . . . . . 16. *Cæsulia.*

3. Bracts not scarious. Style of Inulineæ (see above). Hds. not clustered, often radiate. Pappus of hairs:—
Shrubby, and hds. not radiate (in our species) . . 17. *Inula.*
Herbs. Frt. hardly ribbed. Pappus not double, that of ray scanty or 0 . . . . . 18. *Vicoa.*
Frt. ribbed. Pappus of all fls. double, outer of scales . 19. *Pulicaria.*

Tribe V. Heliantheæ. Hds. radiate, heterogamous (unisexual in *Xanthium*), rarely ligules absent. Receptacle paleaceous. Anthers ecaudate. Style somewhat flattened truncate or appendiculate, stigma marginal narrow or broader and meeting in the middle (in sterile fls. often style entire). Pappus of 2–4 awns or bristles or paleaceous or 0, rarely plumose. Leaves often opposite.

1. Involucral bracts of female heads forming a 2-celled utricle, each cell with a single flower, armed with spines in fruit . . . . . 20. *Xanthium.*
2. Involucre normal. Hds. heterogamous, several-many-fld:—
a. Leaves opposite. Cypsele not dorsally compressed. Hds. not very large:—
i. Inner involucral bracts embracing the outer frts. Pappus 0:—
Outer involucral bracts 5 spreading narrow glandular 21. *Siegesbeckia.*
Outer involucral bracts 4 in opp. pairs, broad . . 22. *Eubydra.*
ii. Inner involucral bracts not embracing the outer frts., pales of receptacle narrow. Pappus 0 or 2 teeth 23. *Eclipta.*
iii. Involucral bracts not embracing frts. but pales of receptacle concave and embracing the frts.:—
Ray fls. with small white ligules. Pappus of 2–5 unequal bristles connate at base . . . 24. *Blainvillea.*
Ray with yellow ligules. Pappus of minute scales with 1–few bristles or 0. Recept. not elongate . 25. *Wedelia.*
Ray with yellow ligules. Pappus of 2–3 bristles or 0. Receptacle very elongate . . . . 26. *Spilanthes.*
b. L. opp. or alternate. Heads (Sunflowers) very large Pappus of 1–3 deciduous bristles or scales or both:—
Peduncle not clavate above. Ligules yellow . . 27. *Helianthus.*
Peduncles clavate above, ligules often red . . . 27*. *Tithonia.*
c. Cypseles dorsally compressed. Pappus of 2–4 strong awns or a minute corona (exc. 28 and 34):—
i. Pappus 0: Leaves opp. simple . . . . 28. *Guizotia.*
ii. Pappus of 2–4 strong awns. L. pinnate or pinnatifid:—
* Leaves opposite:—
Cypsele slender, not beaked . . . . 29. *Bidens.*
Cypsele slender and beaked . . . . 30. *Cosmos.*
** Leaves alternate or chiefly radical:—
Cypsele linear with 2 retrorsely hispid awns . 31. *Glossogyne.*
Cypsele linear-oblong with two smooth awns . 32. *Glossocardia.*
iii. Pappus a minute corona. L. alternate . . . 33. *Chrysanthellum.*
d. Cypsele turbinate or oblong. Pappus of feathery bristles . . . . . 34. *Tridax.*

Tribe VI. Heleniеæ. Hds. usually radiate and heterogamous but ligules sometimes minute or suppressed. Bracts of involucre herbaceous 1-2- rarely 3-seriate. Receptacle without pales. Style of herm. fl. as in Heliantheæ. Pappus 0 or of scales or bristles. (None indigenous.)

L. opp. without oil-glands. Hds. compound . . . 35. *Flaveria.*
L. opp. with oil-glands. Hds. simple . . . . 36. *Tagetes.*

Tribe VII. Anthemideæ. Heads rayed or disciform, heterogamous or homogamous. Involucral bracts 2-many-seriate, dry or with scarious tips. Receptacle not paleaceous (in our species). Anthers ecaudate. Style-arms truncate. Pappus 0 or of short scales. L. alternate. (The *Chrysanthemum*, often grown in India, may be taken as an illustration of this tribe but our species have not radiate heads.)

1. Heads solitary, disciform and heterogamous :—
   a. Leaves pinnatifid. Hds. peduncled . . . . 37. *Cotula.*
   b. L. simple. Hds. sessile or shortly peduncled :—
      Involucral bracts spreading in fruit . . . . . 38. *Centipeda.*
      Involucral bracts incurved in fruit . . . . . 39. *Sphæromorphæa.*
2. Heads panicled, disciform, homogamous or heterogamous . . . . . 40. *Artemisia.*

Tribe VIII. Senecionidæ. Heads heterogamous, rayed or disciform. Involucral bracts mostly 1-seriate and subequal often forming a tube with a few bracteoles at the base. Receptacle not paleaceous (sometimes fimbrillate). Anthers rarely tailed. Style-arms truncate penicillate round the tip (rarely tip conic, *e. g. Emilia*, or obtuse, very rarely acute). Pappus of fine hairs. Leaves alternate.

Hds. disciform. Fls. pink . . . . . 41. *Emilia.*
Hds. radiate. Fls. yellow . . . . . 42. *Senecio.*

Tribe IX. Calenduleæ. Hds. radiate. Involucral bracts 1–2-seriate. Receptacle naked. Anther cells mucronate. Style-arms truncate. Cypsele large, deformed, often tubercled. Leaves alternate . . . . . 42*. *Calendula.*

B. Brush hairs on or below the fork forming a corona, or style thickened or otherwise changed at the fork (*cp.* p. 454) :—

Tribe X. Cynaroideæ. Fls. all tubular. Involucral bracts many-seriate, tips scarious spinous or foliaceous. Receptacle densely bristly (paleaceous in 46). Anther-cells tailed. Pappus various or 0. Leaves alt. often spinescent.

1. Hds. 1-fld. crowded into involucrate compound hds. . 43. *Echinops.*
2. Heads many-fld. simple :—
   a. Basal areole of cypsele horizontal :—
      i. L. spinescent. Filaments papillose-hairy . . 44. *Cnicus.*
      As in 44 but hds. very large, bracts appendaged . 44*. *Cynara.*
      ii. Leaves unarmed :—
         Filaments free, glabrous. Pappus feathery . . 45. *Saussurea.*
         Fil. free, hairy. Recept. paleaceous. Pappus sub-paleaceous . . . . . 46. *Goniocaulon.*
   b. Basal areole of cypsele oblique or lateral :—
      i. Involucre not bracteate at base. Fls. purple or white :—
         Cypsele smooth . . . . . 47. *Tricholepis.*
         Cypsele 10–15-ribbed . . . . . 48. *Volutarella.*
      ii. Invol. bracteate at base with spinous leaves. Fls. orange-red . . . . . 49. *Carthamus.*

II. **Liguliflore**æ. Sap milky. All florets ligulate (*cp.* p. 454) :—

Tribe XI. Cichorieæ. Hds. homogamous and fls. similar with truncate 5-toothed ligule. Style-arms slender. Leaves alternate.

1. Cypsele truncate. Fls. blue. Pappus paleaceous . . 49*. *Cichorium.*
2. Cypsele narrowed or truncate. Fls. yellow. Pappus hairy :—
   Cypsele narrowed each end, many-ribbed or ribbed and grooved. Leaves chiefly radical . . . . . 50. *Crepis.*
   Cypsele flattened, beaked, ribbed on faces . . . 51. *Lactuca.*
   Cypsele truncate, columnar with few stout ribs, stems more or less prostrate or slender . . . . . 52. *Launæa.*
   Cypsele sub-terete or compressed, not beaked, ribbed, stems stout erect leafy . . . . . 53. *Sonchus.*

ARTIFICIAL KEY TO COMPOSITÆ.

§ Juice not milky. Inner flowers of head not ligulate (*cp.* p. 459) :—
   I. All flowers similar and tubular (*cp.* pp. 457 and 458) :—
      A. Receptacle neither paleaceous nor densely bristly and leaves never spinose :—

1. Heads purple or pink. Leaves alt. or radical :—
   a. Invol. bracts many :—
      Heads simple. Stem leafy . . . . . 1. *Vernonia.*
      Heads compound. Leaves mostly radical . 2. *Elephantopus.*
   b. Invol. bracts 1-seriate, more or less connate . 41. *Emilia.*
2. Hds. blue, pink or white. Leaves opposite :—
   Fls. white. Pappus-hairs 3–5, short . . . 3. *Adenostemma.*
   Fls. blue or white. Pappus of 5 awned scales . 4. *Ageratum.*
   Scandent. Fls. white. Introduced . . . 4*. *Mikania.*
3. Fls. white in 1-fld. heads collected into compound heads on axillary receptacles. L. alternate . 16. *Cæsulia.*
4. Fls. yellow (normally outer liguiate). L. opposite 35. *Flaveria.*

B. Receptacle densely bristly (paleaceous in 46; see also 14, in which filiform outer fls. are sometimes absent). Leaves or involucral bracts often spinous or cottony :—
1. Each head 1-fld. surrounded by an involucre of spinescent bracts and crowded into dense balls 43. *Echinops.*
2. Each head several-fld, but not compound :—
   a. Flowers usually purple, never orange :—
      i. Leaves and invol. bracts not spinescent (or sub-spinescent in *Tricholepis*) :—
         More or less cottony. Fil. free, glabrous . 45. *Saussurea.*
         Glabrous. Filaments papillose . . . 47. *Tricholepis.*
         Recept. paleaceous. Glabrous. Fil. hairy 46. *Goniocaulon.*
      ii. Leaves or invol. bracts or both spinescent :—
         * Heads m.s. purple or rarely white :—
            Pappus hairs feathery, connate into a ring at base . . . . . 44. *Cnicus.*
            Pappus of unequal scaberulous hairs. Frt. ribbed . . . . . 48. *Volutarella.*
         ** Heads very large, over 3″ diam., blue . 44*. *Cynara.*
   b. Fls. orange-red. Invol. and leaves often spinose 49. *Carthamus.*

II. All flowers tubular but outer different, filiform and usually 2–3-toothed, inner stouter usually 5-toothed, outer usually female, inner usually hermaphrodite (*cp.* pp. 456 and 458) :—

A. Pappus 0 or insignificant. Small herbs :—
1. Heads purple or rose :—
   a. Stems or peduncles winged. Leaves not pinnatifid :—
      Heads not compound, under ·5″ . . . 12. *Epaltes.*
      Heads compound. Clusters ·5–1″ . . . 13. *Sphæranthus.*
   b. Stems or peduncles not winged. Leaves pinnatifid . . . . . 6. *Cyathocline.*
2. Heads green, grey or yellow :—
   a. Receptacle paleaceous. Heads compound . 14. *Athroisma.*
   b. Receptacle not paleaceous. Heads not compound :—
      i. Small herbs with solitary or sub-solitary heads :—
         Leaves pinnatifid. Pappus minute cupular 7. *Grangea.*
         L. pinnatifid. Pappus a small auricle or 0 37. *Cotula.*
         L. simple. Invol. bracts spreading in fruit 38. *Centipeda.*
         L. simple. Invol. bracts incurved in fruit 39. *Sphæromorphæa.*
      ii. Erect herbs with much panicled heads . 40. *Artemisia.*

B. Pappus distinct, of hairs or bristles. Receptacle not paleaceous :—
1. Shrub growing in salt marshes . . . . 11. *Pluchea.*
2. Terrestrial herbs (or shrubby in *Inula*) :—
   a. Anther-bases entire or sagittate, not tailed :—
      Hds. yellow or pinkish. Style tips of Astereæ 8. *Conyza.*
      Hds. purple or pink. Style of Vernonieæ . 9. *Laggera.*
      Hds. greenish or yellow. Style of Vernonieæ. 10. *Blumea* (few).
   b. Anther-bases tailed :—
      Invol. bracts not scarious. Style of Vernonieæ 10. *Blumea.*

Invol. bracts scarious or hyaline. Style-arms truncate . . . . . 15. *Gnaphalium.*
Invol. bracts not scarious. Large herb with leaves white beneath . . . . . 17. *Inula.*

III. Inner flowers tubular, outer (ray) fls. ligulate (*ep.* pp. 456, 457):—

A. Receptacle not paleaceous:—

1. Ray fls. neither yellow nor orange. Pappus of hairs:—
Ray fls. several-seriate, very narrow . . . 5. *Erigeron.*
Ray fls. 1- rarely 2-seriate, broader . . . 5*. *Aster.*
Outer invol. bracts foliaceous. Pappus with an outer ring of short connate bristles . . . 5**. *Callistephus.*

2. Ray flowers yellow or orange:—
a. Pappus of hairs:—
i. Style arms slender acute.
Cypsele hardly ribbed. Pappus without scales 18. *Vicoa.*
Cypsele ribbed. Pappus with outer row of scales . . . . . 19. *Pulicaria.*
ii. Style arms truncate with a crown of short hairs . . . . . 42. *Senecio.*
b. Pappus of 5-6 scales. Recept. fimbrillate . 36. *Tagetes.*
c. Pappus 0:—
Hds. simple, large, orange . . . . . 42*. *Calendula.*
Heads compound, ray fls. only 1 in each head, very short, tongue-like. Leaves opp. . . 35. *Flaveria.*

B. Receptacle paleaceous:—

1. Male and female heads separate. Involucre of female capsule-like, 2-celled. Leaves alternate 20. *Xanthium.*

2. Male and female heads not separate:—
a. Leaves alternate, pinnatifid or pinnatisect (rarely lower opp. in 32):—
i. Heads compound . . . . . 14. *Athroisma.*
ii. Heads simple:—
Pappus of 2 smooth stiff awns . . . 32. *Glossocardia.*
Pappus of 2 retrorsely scabrid bristles . 31. *Glossogyne.*
Pappus a minute rim . . . . . 33. *Chrysanthellum.*
b. Leaves opposite or upper only alternate:—
i. Lower leaves pinnatisect or 1-2-pinnate:—
* Pappus of 2 awns:—
Ligules white or yellowish. Frt. not beaked . . . . . 29. *Bidens.*
Ligules rosy or orange. Fruit beaked if white or yellow . . . . . 30. *Cosmos.*
** Pappus of feathery scales . . . 34. *Tridax.*
ii. Leaves entire, serrate or crenate:—
* Inner invol. bracts and often the pales embracing the flowers:—
Outer invol. bracts 5 spreading, glandular . . . . . 21. *Siegesbeckia.*
Outer invol. bracts 4, broad, not glandular . . . . . 22. *Euhydra.*
** Inner invol. bracts not embracing the flowers but pales of recept. embracing the fls.:—
! Small or m.s. herbs with heads under 2″ diam:—
Ligules small white . . . . 24. *Blainvillea.*
Ligules small yellow. Receptacle elongate . . . . . 26. *Spilanthes.*
Ligules yellow. Receptacle not elongate . . . . . 25. *Wedelia.*
!! Large herbs with heads over 2″ diam. (Sunflowers):—
Fls. usually yellow, peduncle not clavate . . . . . 28. *Helianthus.*

Fls. often red, peduncle clavate above . . . . . 27*. *Tithonia.*
*** Neither involucre bracts nor pales embracing the flowers:—
Fls. white, outer involucre bracts many . 23. *Eclipta.*
Fls. yellow, outer involucre bracts 5 subfoliaceous . . . . . 28. *Guizotia.*
§§ Herbs with usually milky juice. All flowers ligulate (*ep.* p. 456):—
I. Flowers blue . . . . . 49*. *Cichorium.*
II. Flowers yellow:—
A. Stout fistular erect herbs with more or less spinulose serrate leaves and sub-corymbose heads . . 53. *Sonchus.*
B. Leaves all radical or stems slender, often spreading or procumbent:—
1. Cypselas beaked, compressed . . . . . 51. *Lactuca.*
2. Cypselas not beaked, rarely compressed:—
Cypselas narrowed to each end, ribbed . . . 50. *Crepis.*
Cypselas columnar (ribs very stout), truncate . 52. *Launæa.*

1. VERNONIA, *Schreb.*

Herbs, shrubs or small trees, sometimes climbing. Leaves alternate, often toothed, sometimes gland-punctate. Heads terminal or axillary, solitary or panicled, homogamous, with the flowers purple and all tubular. Involucral bracts many-seriate, inner longest. Receptacle naked or pitted, sometimes shortly hairy. Corolla equal slender, lobes 5 narrow. Anther-bases obtuse or minutely tailed. Style-arms subulate or linear. Fruits truncate striate, ribbed or angled, pappus usually long with many minutely plumose hairs and often a row of shorter outer hairs, bristles or scales.

A. Heads solitary or clustered, sessile or subsessile. Fr. 8–10-ribbed:—
1. Bracts aristate or aristulate. Involucre over ·4″ long:—
Hds. 1–3 axillary and terminal, bracts tapering . . . 1. *teres.*
Hds. clustered at the ends of short axillary branches, bracts obtuse below the short awn . . . . . 2. *Roxburghii.*
2. Bracts acute or mucronate. Involucre under ·3″ long:—
Heads clustered on the branches of a large panicle . . 3. *divergens.*
B. Heads distinctly peduncled:—
Coarse herb. Involucre ·5″ long. Fr. ribbed . . . . 4. *anthelmintica.*
Slender herb. Involucre ·2″ long. Fr. not ribbed . . . 5. *cinerea.*

1. V. teres, *Wall.*

A rigid scabrid herb with simple erect leafy stems 1–2·5 ft. high, pubescent with brown hairs. Leaves hard sub-sessile narrowly oblong to obovate, 2–5″ long, acute scabrid and punctulate above, hispid beneath, with few distant mucronate teeth, reticulate. Heads large, ·6–·8″ long and nearly as broad, sessile mostly solitary in the axils but with often 2–3 terminal. Involucre rather cobwebby, bracts lanceolate or outer subulate, often squarrose, tapering into a short awn. Fruit about 8–10-ribbed, silky, ·13–·15″ long with pappus ·3″ long, dirty white or reddish.

Common, especially on clay soils in open scrub jungles. Fl., Fr. Oct.–Dec.

2. V. Roxburghii, *Less.* Dora bohok', *S.*; Agnijal, *Or.*; Ban Jatangi (Bonai).

An erect stout rigid herb 3–4 ft. with harsh sub-sessile or shortly petioled oblanceolate or obovate shortly acuminate acutely

serrate leaves 3–7″ long by 1–2·75″ broad, and purple heads clustered at the ends of the branchlets often in considerable panicles, sometimes and in young plants only at the top of the main stem, when it somewhat resembles the last species. Involucre ·4–·5″ long, outer bracts not at all squarrose, outer shorter ones sometimes lanceolate but inner linear-oblong obtuse or subacute, the midrib ending in a very short awn. Fruits ·12–·14″, truncate silky between the 8–10 ribs. Pappus brownish-white, outer shorter hairs often 0.

Waste ground and open scrub jungles, Central and Southern areas, frequent! Very common on the trap hills of the Santal Parganas! Common at Neterhat 3000 ft. Fl. Sept.–Feb. and sometimes also in h.s.

Stems more or less striate and hairy. L. scabrid above, usually hispid on the nerves beneath, base tapering, petiole sometimes ·3″. Bracts often red at the ends.

The plant is often handsome when well grown. The leaves are ground up in water and the mixture drunk for cholera in Sambalpur.

3. **B. divergens**, *Benth.* Bara pathol, *S.*

A stout perennial 4–8 ft. high. Leaves distinctly petioled, elliptic oblanceolate or obovate, serrate, hispidulous above, hispid-pubescent beneath, 3–7″. Heads much smaller than in the preceding, ·25″ long, or with the flowers ·4″ long, crowded in large corymbose panicles at the top of the stems. Involucral bracts rather few, outer short, inner oblong obtuse with a short pointed mucro scarcely awned. Fruit glabrous pale brown truncate about 8–10-ribbed, ·07″–·08″ with pappus reddish or white ·2″ long, outer short scales 0.

Usually in the damper districts or on high hills. Korcho Hill, S.P.! Neterhat, 3000 ft.! Parasnath, 4000 ft.! Kalahandi, *Cooper*! Fl. Dec.–Jan. Fr. Feb.–May.

Stems ridged, pubescent. Petiole ·2–1″ long. Under-surface of leaves with minute glistening glands. Heads narrowly campanulate.

4. **V. anthelmintica**, *Willd.* Syn. Centratherum anthelminticum, *O. Kuntz;* Saoraj, *S.*

A coarse annual 2–7 ft. high with coarsely dentate or serrate elliptic or obovate, more rarely lanceolate, leaves attenuate at the base into a short petiole, lower often 8″ by 3″, upper gradually smaller and more lanceolate. Heads stout with a stout peduncle ·4–2″ long, often sub-corymbose, oblong ·6–·7″ long (they are usually described as ·5–·75″ broad but this is only the case with dried specimens). Involucre ·4–·5″ long, outer linear-oblong constricted beneath the free green or coloured dilated tips. Fruit ·15″ long truncate black somewhat dilated upwards, ribbed and hairy, outer pappus of linear chaffy scales, inner ·2–·25″ long of hispid hairs.

Usually in shade in village topes. Frequent in Chota Nagpur and S.P.! Probably also in other districts. Fl. Sept.–Dec. Fr. Nov.–Jan.

Stems as thick as the thumb below shortly pubescent or puberulous, paniculately branched above, branches ridged or striate pubescent or tomentose. Leaves rather membranous acuminate. Involucral bracts frequently with spreading tips. Flowers with slender tube ·3–·5′ dilated above into a 5-6-lobed limb. Anthers tailed or acutely sagittate. Longer pappus hairs caducous, scales persistent.

The seeds are highly reputed as a vermifuge. They are also used in conjunction with other medicines for leucoderma (*Nadkarni*).

5. **V. cinerea**, *Less.* Jhurjhuri, *S.*; Barangom, *S.* (*teste Campbell*).

An erect or somewhat decumbent branched herb 8″ to 3 ft. high with slender ribbed hairy stems and often hoary-tomentose branches.

Leaves excessively variable in shape from linear to elliptic, ovate or obovate, entire or toothed, sessile or attenuate into a short petiole, usually ·7–2″ long, always pubescent or hairy. Heads ·25″ oblong peduncled in dense or very loose panicles with light purple flowers. Involucre narrowly campanulate ·2″, bracts mostly linear acuminate spinulose-tipped. Fruit ·05″ long not ribbed, hairy, pappus ·15–·17″ caducous with an outer ring of short persistent hairs or bristles.

A common weed of waste ground. Fl., Fr. most of the year except the h.s.

Lower leaves sometimes 3″ in stout plants. Corolla-lobes linear-oblong. Anthers shortly tailed and apiculate.

The whole plant is used in decoction to promote perspiration in fever. The seed is used as an anthelmintic and also given to horses as a tonic. The flowers are administered (internally) in conjunctivitis (*Nadkarni*). The leaves are eaten as a pot-herb (*Campbell*).

2. ELEPHANTOPUS, *L.*

Herbs with alternate leaves, radical rosulate (in our species). Heads (partial) of 2–5 flowers collected into a dense terminal cluster, bracts of each partial head about 8 dry, flat or conduplicate. Corolla purple, limb 4–5-lobed with the lobes unilateral and limb cleft on the other side. Style arms subulate. Fruit truncate, 10-ribbed. Pappus with rigid slender hairs dilated below, or chaff-like.

1. **E. scaber,** *L.* Samdulan, *H., Beng.*; Manjurjuti, *S.*

An erect rigid herb 8–18″ high with rosulate or clustered and erect obovate or oblanceolate radical leaves 4–6″ long and slender dichotomously branched strigosely hairy stems 8–18″ high with few alternate sessile or amplexicaul leaves 1–3″ long. Clusters of partial heads easily recognisable from the conspicuous cordate leafy bracts, usually 3 in number, and giving the cluster a three-cornered appearance. Fruit ·15″ long, brown, ribbed, hairy, with an oblique callus at the base, pappus of 4–5 rigid scabrid hairs ·2″ long.

Very common in open ground and under partial shade, in all districts. Fls. Sept.–Nov. Fr. Oct.–Dec.

Leaves serrate or crenate, hairy both sides, sec. n. 7–10 and tertiaries raised beneath. Radical leaves with a slender attenuate base or petiole, with sheathing base. Leafy bracts of general head ·4–·8″ long, bracts of partial heads lanceolate spinose-tipped, inner ·4–·5″ long.

3. ADENOSTEMMA, *Forst.*

Herbs with leaves mostly opposite. Flowers never yellow, in homogamous corymbose heads. Involucral bracts many, narrow herbaceous, sometimes connate; receptacle flat naked. Corollas all equal tubular with short tube and campanulate 5-toothed limb. Anthers with a glandular tip, base obtuse. Style arms elongate, dilated above. Fruits obtuse, 5 ribbed, glandular with 3–5 short rigid pappus hairs which are often clavate.

1. **A viscosum,** *Forst.* Syn. Ageratum aquaticum, *F.I.*

A weak herb, often with a decumbent rooting base, corymbosely branched above 18″–24″ high. Leaves from linear or oblong-lanceolate to broadly ovate or cordate, sessile or petioled, crenate or serrate. Heads rather pretty, ·3–·5″ diam., white or somewhat rose-coloured, remarkable from their very long linear-clavate white style-branches.

In grassy places in the damper districts, near nalas and under shade in the dryer districts. Fl., Fr. Oct.–Jan.

Usually more or less pubescent or glandular above. A very variable plant of which there are at least two well-marked forms in our area.

Var. 1, **typica.**

Leaves oblong-lanceolate 2·5–4″ tapering into a short petiole, distantly serrate. Heads without the styles ·25″ long and broad. Involucral bracts oblanceolate-oblong herbaceous 2-seriate. Fls. glandular. Calyx of 3 stipitate glands. Corolla ·12″. Style-arms ·2″ long.

Valleys at higher elevations in Chota Nagpur!

Var. 2, **latifolia.**

Leaves broadly ovate 4″ by 2·5″ attenuate on the petiole. Fruits densely warted.

Purneah.

The common form in the valleys has not been particularly examined. It has broadly ovate leaves.

4. AGERATUM, *L.*

Erect herbs or shrubs with opposite leaves or the upper alternate. Fls. white or purple in corymbose or panicled homogamous heads. Involucral bracts 2–3-seriate; linear, subequal. Corollas all tubular, equal, regular, limb 5-cleft. Anthers appendaged, base obtuse. Style-arms elongate obtuse. Fruits 5-angled with a pappus of 5 short free or connate scales or of 10–20 narrow unequal scales.

1. **A. conyzoides,** *L.* Uchunti, *Beng.*; Poksunga, Boksunga, *Or.* Ilami, *Nep.*

An erect hispidly hairy herb 1–2 ft. high with coarsely crenate ovate hairy petioled leaves 1–3″ long and terminal corymbs of small white or blue-purple heads of flowers ·12–·2″ diam. with campanulate involucre. Fruit black with a pappus of 5-awned scales.

A very common plant but chiefly in the damper districts and often a weed in cultivated fields and gardens! Fl., Fr. all the year round.

5. ERIGERON, *L.*

Herbs or shrubs with alternate leaves and white, blue or purple ray-flowers. Heads heterogamous, rayed, but rays sometimes very small. Ray fls. many-seriate female, ligule small, very slender; disc fls. 2-sexual, tubular, yellow, 5-cleft. Involucre campanulate or hemispheric, bracts few- or many-seriate. Anther bases obtuse, entire. Style arms of herm. fl. flattened with lanceolate or usually short 3-cornered tips. Cypsele compressed, usually small and narrow, margins often nerviform. Pappus a single or double row of bristles, the outer fewer and shorter than the inner.

1. **E. asteroides,** *Roxb.*

An erect rather coarse hairy and glandular herb 6″–2 ft. high, much branched from near the ground with ascending branches often longer than central stem. Radical leaves obovate petioled, coarsely toothed, cauline amplexicaul oblong or somewhat obovate, toothed or lobulate ·5–2″ long. Heads solitary or few and corymbose, peduncled, ·2–·3″ long, ·25–·5″ diam., with 1–2 rows of short spreading very

slender blue ligules, then several rows of filiform whitish female and fewer inner yellow campanulate hermaph. or male florets. Cypsele ·03″, nearly glabrous, flat pale with dirty white or brown pappus ·14–·15″ long, scabrid under magnification.

Chiefly in cultivated ground. Behar, Sone R., *J.D.H.*! Singbhum! Banks of Ganges, S.P., *Kurz*! No doubt also in Purneah as it occurs in Maldah, *Clarke*! and probably in the whole Northern and Southern Central Areas sporadically. Fl., Fr. Oct.–April.

L. mostly about 1″ but rarely 2·5″ with coarse lobules, hairy. Involucre bracts 1–3-seriate, rather hispid and glandular-papillose, inner ·18″ linear with scarious margins often constricted below the recurved tips (or hair-pointed, *C. B. Clarke*). Ray-fls. filiform ·14–·15″ acute and ligulate, intermixed with short filiform-tubular fls. with simple styles. Disc. fls. tubular, ·11″.

Aster differs only from *Erigeron* in that the ray flowers have usually large ligules and are only 1–2-seriate. The cypsele larger. Pappus of scabrid hairs, outer sometimes shorter, rigid and paleaceous. *Aster amellus*, one of the so-called Michaelmas daisies, is common in gardens on the Ranchi plateau. The "Chinese aster" is *Callistephus chinensis*, the inner pappus is of hairs or bristles, the outer a short corona fringed with cilia.

A plant frequently called *Erigeron linifolium* in herbaria (and sometimes *Erigeron canadense*) is *Conyza ambigua, DC, q.v.*

6. CYATHOCLINE, *Cass.*

Annual usually erect odorous herbs with pinnatisect alternate leaves. Heads small variously coloured, panicled, disciform, heterogamous with the outer fls. many-seriate, filiform, female, 2-toothed, the inner hermaphrodite or functionally male, regular, 5-cleft. Involucre hemispheric, bracts sub-2-seriate narrow with scarious margins, receptacle peltate saucer-shaped with raised free margins, naked. Anther-bases truncate. Style of female flower with two arms, of herm. simple or cleft. Fruit minute smooth, pappus 0, or of 4–5 minute gland hairs.

1. **C. lyrata**, *Cass.*

A pretty erect or sometimes decumbent scented herb, usually 8″–2 ft. high with hairy stems, pinnate or pinnatifid leaves, basal attaining 6″ with the lobes toothed or pinnatifid, rhachis winged and toothed, cauline leaves with large auricles. Heads ·2″ diam. bright rose-purple. Disc flowers stout, viscous pubescent with simple style. Fruits somewhat fusiform-oblong, ·015″ long.

In wet places, moist banks, rice-fields, rocks in streams, etc. Fl., Fr. Dec.–March.

7. GRANGEA, *Forsk.*

Suberect or prostrate villous herbs with alternate pinnatifid leaves and sub-globose disciform yellow or yellowish terminal or leaf-opposed heterogamous heads. Outer flowers 1- to many-seriate, filiform, female, 2–4-fid, disc flowers hermaphrodite with very slender tube and campanulate 4–5-cleft limb. Involucre broadly campanulate, bracts few-seriate, outer herbaceous, receptacle convex or conic, naked. Anther-bases obtuse. Style-arms of disc-fls. flattened, cuneate,

obtuse or with triangular points. Fruit flattened or subterete, pappus cupular, formed of the short calyx-tube and often a ring of bristles or short hairs.

1. G. maderaspatana, *Poir.* Bhediachim, *S.*

A procumbent weed with woody rootstock and villous or hirsute branches 3–4″ or up to 10″ long. Leaves oblong pinnatifid or lobulate, often oak-leaf-shaped, villous, radical 1–3″, cauline mostly ·5–1″ long. Heads button-shaped ·25–·4″ diam. shortly peduncled, involucre bracts 2–3-seriate, outer herbaceous oblong ·25″ long. Outer fls. very slender with long exserted style, inner usually with 4-lobed corolla. Anthers appendaged oblong. Fruit stipitate ·1″ long, pale brown, calyx-tube with a ring of short hairs.

A common weed of rice fields, wet ground, etc. Patna! Chota Nagpur! Santal P., *Kurz*! Probably all districts. Fl., Fr. c.s. and h.s.

The flower buds during an epileptic fit are introduced into the nostrils to restore consciousness, *Campbell* (under *Centipeda orbicularis*).*

8. CONYZA, *Less.*

Herbs, sometimes large, with alternate entire or cut leaves and corymbose or panicled heterogamous disciform yellow, or yellowish or, in fruit, reddish heads of flowers. Ray-flowers 0 but outer flowers 2-many-seriate filiform, 2–3-toothed, pale-coloured, inner hermaphrodite yellow, tubular, limb 5-toothed. Involucre campanulate, bracts 2-many-seriate, narrow, outer smaller. Receptacle naked or pitted and fimbriate. Anther bases obtuse entire, connective usually produced. Style arms of outer fls. flattened with long or short tips. Style arms of herm. fl. not very long, flattened, bearing the stigmatic surface in two marginal strips and with short brush-hairs towards the tip. Cypsele minute, compressed with usually nerviform margins and with slender 1-seriate soft pappus hairs.

The genus *Conyza* connects the Asteroideæ with the Inuloideæ through *Laggera* and *Blumea*, from which it differs in the constantly ecaudate anthers and style arms flattened within with a more or less conical papillose tip.

A. Heads very small, ·1″ diam. or less . . . . . 1. *stricta.*
B. Heads over ·1″ diam.:—
1. Leaves entire, shallowly crenate or remotely serrate:—
Tall branched, 5–6 ft., minutely pubescent. Hds. pink . . 2. *viscidula.*
Stems strict, 1–2 ft., grey villous. Hds. yellow. . . . 3. *ambigua.*
2. Leaves distinctly toothed or lobulate:—
Leaves lobulate, grey villous. Disc. fls. ·2″ long . . . 4. *ægyptiaca.*
Leaves serrate, hairy. Disc. fls. ·15″ long . . . . . 5. *japonica.*

1. C. stricta, *Willd.*

An erect herb 2–4 ft. or in some cases 4–6 ft. high fastigiately branched with linear, linear-obcuneate or (lower) oblanceolate leaves 1–2″ long shortly hairy or harshly pubescent both sides, entire or somewhat toothed. Heads very numerous panicled small yellow ovoid ·1″ long or less. Involucre bracts ·07″, linear, 2-seriate, with 1 or more outer ones. Cypsele pale yellow ·7 mm. only, puberulous, pappus silky ·07″ rather scanty white.

In moist and grassy places on the hills and plateaux 2000 ft. and above. Ranchi.

* See note under *Centipeda*, which this little plant closely resembles.

Horhap forest, etc.! Neterhat! Singbhum Hills! Parasnath! Fl., Fr. Oct.–Dec.

A very distinct plant, somewhat harshly pubescent all over. Receptacle flat, naked. Anther tips produced as very narrow appendages.

2. **C. viscidula,** *Wall.*

A tall straight herb 5–6 ft. high with stem very striate as thick as the finger below and with very numerous obliquely spreading branches bearing lateral and terminal panicles of pinkish flowers. Leaves lanceolate, lower attaining 8″ by 2·5″, smaller upwards, entire or shallowly crenate with the sinuses mucronate, those on the flowering branches mostly entire. Heads ·25″ oblong, with pink-tipped bracts and often pink outer florets. Achenes very minute, ·02″ long, pale with nerviform margin.

Moist grassy glades. Singbhum, not common! Hazaribagh, on Parasnath! Neterhat (Ranchi and Palamau, elev. 3000 ft.! Jaigri, Palamau, 3000 ft., *Gamble*! Fl., Fr. Dec.–Feb., also April.

Stems and branches minutely pubescent. Leaves puberulous beneath and on the nerves above, narrowed at base into a short sub-amplexicaul petiole. Flowering branches more pubescent, repeatedly branched, ultimate 1·5–2″ long bearing a loose corymb of slender-pedicelled heads. Involucre campanulate with about 20 linear 3-seriate bracts ·17″ long, bristle-pointed with a green centre and narrow scarious margins, hairy and glandular outside. Herm.-corolla with linear-oblong lobes. Anther cells apiculate. Stigmatic arms long papillose.

3. **C. ambigua,** *DC.* Syn. Erigeron linifolius, *Willd.* (*Clarke,* Compos.)

A grey or glaucous-green herb, 1–2·5 ft. high with usually several erect stems from the root. Stems appressed hairy and also villous, densely clothed with sessile linear, entire or remotely serrate leaves 1·5–2·5″ long by about ·2″ broad, subtomentose and villous beneath, densely hairy above. Branches of racemose panicle each with 1–5 heads ·15–·2″ long and broad in narrow racemiform panicles. Bracts many linear with hairy centre and scarious margins, very acute. Outer flowers very numerous pale ·15″, filiform with 2–3 very minute acute teeth. Disc flowers slender pale-yellow. Anthers narrow somewhat appendiculate. Cypsele pale-brown ·05″ compressed with nerviform margins sparsely silky. Pappus dirty white as long as the corolla.

Sunny places, highest hills of Chota Nagpur, over 2500 ft.! Fl., Fr. April–May.

Whether this is really *Willdenough's* "*Erigeron linifolius*" I am not sure, but it is certainly *Clarke's* and probably the plant alluded to on p. 254, *F.B.I.*, and repeatedly called by that name in *Herbaria*. I doubt its being merely an escape in India. I have found it also in the mountains of Jaunsar, and it has no appearance of being an escape in our province. Cases of perfect naturalisation such as *Tridax procumbens* are hardly parallel, as these plants are as much at home in the plains as in the hills and there are no obstacles to their wide spread.

4. **C. ægyptiaca,** *Ait.*

An erect strict herb 1–2 ft. high with sometimes several stems from the same rootstock, villously hairy and also with very short underlying gland hairs. Leaves erect narrow sessile with linear lobes or deeply gashed, 1·5–2″ long. Heads in terminal small panicled corymbs, broadly-oblong or ovoid, about ·2″ long and broad, yellow but soon becoming white, sub-globose and ·4″ diam. with a very soft pappus. Cypsele pale, under ·05″, compressed oblong-obovoid thinly pubescent.

Higher elevations only. On the grassy plateaux of Chota Nagpur, 3000 ft.! Fl., Fr. May–June.

Involucre bracts hispid-hairy in centre, scarious at the margins, longest ·25″. Outer flowers very many filiform, style far exsert and undivided. Disc fls. comparatively few ·2″ long with pubescent tube and yellow lanceolate lobes. Anthers appendaged. Style branches short below the very narrowly conical or lanceolate papillose tip. Hypanthium silky. Pappus rather scanty, hairs scabrid.

5. **C. japonica,** *Less.*

Perhaps only a variety of the last, smaller, 8–12″ high, more rigidly hairy and leaves not lobed but with sharp deep serratures. Heads smaller ultimately loosely corymbosely panicled. Cypsele minute, thinly shortly silky, pappus as long as corolla.

Same localities as the preceding. Neterhat, 3000 ft.! Fl., Fr. May–June.

Lower leaves 1·5″ oblanceolate sub-petioled, cauline oblong 1–1·5″ with amplexicaul or cordate base. Heads ·2″ long oblong or ovoid, at first in clusters at the top of the stem. Involucre bracts linear ·15″ hairy with membranous margins. Disc fls. ·15″. Anthers produced beyond the cells as in the last. Style arms lance-shaped flattened.

9. LAGGERA, *Sch.-Bip.*

(Here limited to *Blumea*, Sect. Caulopteræ of *De Candolle*.)

Usually coarse herbs with leaves frequently sessile or decurrent on the stem. Heads large or m.s. with the outer involucral bracts squarrose at the tip and florets purple. Anther bases mucronate or sagittate without slender tails (though short tails are sometimes present). Other characters of *Blumea*.

Leaf bases decurrent as long continuous wings on the internodes	1. *alata*
Internodes with deeply lobed or toothed wings nearly glabrous	2. *pterodonta*.
Internodes not winged, leaves not decurrent or very slightly so, villous	3. *aurita*.

1. **L. alata,** *Schultz-Bip.* Charsira dare, *S.*

A stout much-branched leafy pubescent or tomentose herb 2–6 ft. high easily recognised by the continuous entire wings on the stems and branches. Leaves oblong or oblong-oblanceolate sessile with the decurrent bases forming the wings, 1–4″ long with small mucronate teeth. Heads ·35″ long and nearly as broad with purple florets and outer involucre bracts with spreading and recurved tips, usually 2–3 subracemose on the numerous axillary branchlets, drooping in fruit. Cypsele silky ·03–·04″ long with persistent white pappus.

Grassy places at the higher elevations. Neterhat, common! Parasnath! Fl., Fr., Nov.–Jan.

2. **L. pterodonta,** *Benth.*

A stout much-branched leafy glabrous or puberulous herb 3–5 ft. high easily recognised by the deeply toothed, lobed or interrupted wings on the stems and branches, and the sessile oblanceolate leaves which are toothed and usually pinnatifid at the base. Heads as large as in the last often on slender peduncles, and with glabrous rigid involucre bracts.

Ranchi, under trees usually near houses! Manbhum. *Campbell*! Fl., Fr. r.s. and c.s.

The lobes of the wings are usually linear-oblong, very unequal, rounded or acute at tip and sometimes ·7″ long.

3. **L. aurita,** *Schultz-Bip.*

A coarse strongly scented (somewhat like turpentine) grey-green villous and glandular herb 2–3 ft. high, often much branched from the large tap root. Stems well clothed with deeply lobed or pinnatifid sessile leaves 1·5–2·5″ long with the basal lobes shortly decurrent on the stem. Heads ovoid ·3–·5″ long and broad, on peduncles 1–2″ long, in sub-racemes and corymbs at the ends of the upper branchlets. Corolla and anthers purple.

Waste places. Singbhum! Manbhum, *Camp.*! Fl., Fr. Jan.–March.
Stems with usually few lateral branches but corymbosely branched at the summit. Leaf-lobes toothed, villous both sides and with short gland-tipped hairs. Outer involucre bracts linear spreading and recurved, villous, inner straight often with purplish sub-spinulose tips. The anthers have short tails but tails of adjacent anthers connate. Style pubescent, arms very short obtuse. Cypsele hairy. Pappus long white persistent.

10. BLUMEA, *DC.*

Herbs with alternate leaves and small or m.s. heads of yellowish rarely purple or white florets. Heads not rayed. Involucre ovoid or campanulate or conical of very narrow bracts imbricate in several series, outer smaller. Receptacle flat or convex glabrous or pubescent. Outer florets numerous, female, filiform with corolla very minutely 2–3-toothed, inner florets 2-sexual or functionally 1-sexual narrowly tubular-funnel-shaped, 5-toothed. Anther bases with slender tails or, if anthers are non-polliniferous then often ecaudate (all ecaudate in *B. flava*), tips often empty membranous obtuse or truncate, pollen spinulose. Fls. usually proterandrous in perfect flowers. Style finally exserted with short filiform or linear-subulate, obtuse arms without conical tip, minutely papillose. Cypseles small subterete, angled or ribbed. Pappus scanty and often caducous with the hairs microscopically hairy, sometimes a very minute scarious ring in addition to the hairs.

Some of the species are almost impossible to strictly define and single key characters can only serve as a rough guide. It is believed that many of the forms are hybrids.

I. Decumbent or with many branches spreading from the root. Leaves not lobed :—
  Heads solitary. L. half amplexicaul entire or coarsely toothed . . . . . 1. *amplectens.*
  Heads corymbose, rarely sub-solitary. L. sessile, spinulosely toothed . . . . . 2. *oxyodonta.*
II. Erect. Heads clustered or panicled :—
  A. Heads sessile or nearly so, single and in distinct clusters along the stem and branches and fascicled at their ends :—
    Stems white-woolly. Heads lemon-yellow with yellowish bracts . . . . . 3. *Hamiltoni.*
    Hairy or glabrescent. Heads sessile, involucre purple, florets orange yellow . . . . . 4. *glomerata.*
    Glandular-pubescent. Stems purple. Heads pedicelled, chiefly terminal, florets yellow . . . . . 5. *atropurpurea.*
  B. Heads not clustered or, if clustered, then clusters very numerous and panicled (exc. one variety of *virens*), never lemon yellow. Anthers of polleniferous fls. caudate :—
    1. Florets purple or the outer white, hds. not over ·2″ by ·1″, in dense panicles. L. simply toothed, not lobed . 6. *Wightiana.*

2. Florets not purple. Heads small or m.s. :—
a. Heads clustered at the ends of the panicle-branches. Cypsele angled, rarely also faintly ribbed :—
Height 1–2 ft. Lower leaves often lobulate or cut. Upper leaves simply toothed . . . . . 7. *lacera*.
b. Heads not clustered (except when young) but pedicels usually divaricate. Cypsele distinctly ribbed, silky :—
Height 2–3 ft. All leaves more or less deeply lobed or gashed. Heads small, receptact. pubescent . 8. *laciniata*.
Height 2–3 ft. Leaves variously cut. Hds. ·25–·3″, recept. pubescent . . . . . 9. *Jacquemontii*.
Height 2–6 ft. Leaves very membranous, often glabrous, upper simply toothed. Heads small, under ·25″, recept. glabrous. Bracts mostly spinulose-tipped . . . . . 10. *virens*.
As in *virens* but bracts tipped with hairs . . . Var.
C. Heads in very open panicles on slender pedicels, florets lemon-yellow or golden. Anthers ecaudate . . . 11. *flava*.

1. **B. amplectens**, *DC.*

A herb with several stems from the root, villous above, sparsely hairy and usually reddish below. Leaves oblong or oblanceolate, lower attaining 3·5″, upper ·5–1·5″ amplexicaul, young hairy, old hispidulous, entire or remotely toothed. Heads yellow, m.s., ·25–·3″ diam., solitary at the ends of long bracteate peduncles 1–1·5″ long (but young often subcorymbose before the shoots lengthen). Involbracts almost filiform, outer hairy and with capillary tips. Receptacle rather convex. Lobes of herm. fl. hairy. Cypsele minute, sparsely hairy with a crown of minute pales and few deciduous hairs.

Khandpara State, near the Mahanadi! Fl. March.
The heads are sometimes entirely female with a ring of empty ecaudate anthers round the style of the central flowers.

2. **B. oxyodonta**, *DC.*

A small species with many decumbent branches 4–10″ long spreading from the root, with oblong, elliptic or mostly obovate leaves ·5–1″, rarely the lower ones attaining 3″ and petioled, those on the branches sessile, thinly hairy to tomentose, nerves excurrent as spinulose teeth. Heads subsolitary or clustered or panicled about ·2″ long, on short or long often tomentose and glandular pedicels. Involbracts linear with scarious margins, nearly glabrous or pubescent or tomentose. Cypsele nearly glabrous 8–10-ribbed.

Common in open pasture lands. Bettiah, *Clarke*! Throughout Chota Nagpur ascending to Parasnath! Probably throughout the province. Fl., Fr. Jan.–June.

3. **B. Hamiltoni**, *DC.* Syn. B. hieracifolia, var. Hamiltoni, *F.B.I.*

An erect softly lanuginous herb 1–2 ft. high with one or several stems from a rosette of radical leaves scarcely branched, bearing distant clusters of lemon-yellow flowers in the axils of bractiform leaves and densely fascicled at the top of the stem.

Damp pastures and open wet ground. Neterhat 3000 ft.! Fl. May–June.
A pretty species easily recognised from its white woolly stems. L. oblanceolate lower 1–3″ cottony beneath, regularly dentate with small teeth, base tapering, petiole 0, upper leaves gradually smaller. Heads ovoid ·25″ by ·15″, shortly pedicelled, rarely ·5″ in fruit. Bracts linear villous. Cypsele brown slenderly 5-ridged and thinly pubescent.

4. **B. glomerata,** *DC.* Syn. Conyza fistulosa, *Roxb.*

An erect usually rather slender annual 8″–2 ft. high with elliptic or obovate or oblanceolate sharply denticulate leaves, hairy especially about the mid-rib beneath, glabrescent above; in the smaller plants a simple elongating stem with solitary and clustered sessile heads with purple bracts and yellow flowers forming a dense spike above; in the larger with slender erect or ascending branches similarly bearing heads of flowers which are about ·2–·25″ long.

Dry places such as along boundary- and fire-lines. Chota Nagpur, common! Parasnath, *Clarke*! Behar, *J.D.H.*! Santal Parganas! Sambalpur! Probably throughout the area. Fl., Fr. Jan.–May.

L. sessile or narrowed into a slender petiole, lowest attain 4–5″ but often much smaller, and gradually becoming smaller and more sessile upwards, often sinuate rarely slightly lobulate. The shining purple bracts and often generally purple tinge of the inflorescence makes it rather a pretty plant. Receptacle glabrous or pilose. Tips of herm. corolla sometimes pilose. Achenes glabrous or pubescent, striate or ribbed.

Forms with hairy receptacles or ribbed cypseles would be placed by some botanists under *B. membranacea*. I only do so if both characters exist together and are accompanied by membranous leaves.

5. **B. atropurpurea,** *Haines.* Syn. B. membranacea, var. gracilis, *J.D.H.?*

An erect strict herb 2–2·5 ft. high with simple striate purple stem densely glandular-pubescent above and with a few long villi. Leaves simple obovate, often purple, larger at base of stem 3–4″ including the short petiole, smaller upwards with sessile decurrent base and becoming bractiform, lower entire and denticulate or sinuate and lyrate, upper narrower and dentate, finely pubescent beneath and with sessile glands, shortly sparsely hairy above. Heads ·2″ by ·15″ broad like those of *B. glomerata* but pedicelled, solitary and clustered towards the end of the stem and of numerous slender ascending branches 2–3″ long in the lower part. Outer bracts with purple margins and green or black mid-rib spinose-tipped, inner green, ciliate. Receptacle glabrous. Corolla lobes with sessile glands. Pappus exceeding the corolla. Achenes minutely pubescent ribbed.

Glades and open grassy places, Purneah. Fl., Fr. Dec.–Jan.

This differs from *B. subcapitata* (*Conyza subcapitata, Wall.*) in the absence of the villous tomentum and in the less lacerate leaves and the close glandular pubescense. It connects *B. glomerata, DC.*, and *B. lacera, DC.* According to diagnoses it might also be *B. membranacea* var. *gracilis*, but it is entirely different in general appearance and leaf texture.

6. **B. Wightiana,** *DC.*

A pleasantly aromatic (smell of hops) usually erect herb with several stems from the root 8–18″ high. Leaves at base of stem 2–4″ long, cauline ·7–2″ including the petiole, obovate or elliptic and tapering into the petiole, never lobed but margin with small sharp teeth, and sometimes also dentate, both surfaces closely hairy or pubescent (or in one form thinly hairy and glandular). Heads often pale purple small, clustered, or in dense cymes at the top of the stem or in very many flowered dense narrow panicles, branches of panicle pubescent and glandular as also are the bracts of the involucre. Flowering heads ovoid ·2″ long by ·1″ wide or finally cylindric, often diœcious. Corolla pale purple or white at the tip, lobes of herm. fl.

glandular or minutely ciliolate. Achenes pale brown ·07 mm. minutely pubescent, not or very indistinctly angled.

Rather common but chiefly on the higher hills. Ranchi, Singbhum and Palamau, 2000 ft., common at Neterhat, 3000 ft.! Manbhum, *Campbell*! Parasnath! Santal Parganas, *Kurz*! Kalahandi. *Cooper*!

The less hairy and more open-panicled forms in the absence of corolla sometimes resemble small forms of *B. membranacea*; they may be distinguished by the linear acuminate involucre bracts with softly hairy tips (whereas those of *B. membranacea*, at least in one form, are more rigid and spinous-tipped), and by the cypseles.

7. **B. lacera,** *DC.* Syn. B. lactucæfolia, *DC.?*

A coarse or rather slender very variable weed, often grey in the more silky forms, with a strong camphor or turpentine odour, sub-tomentose or pubescent or very sericeous, or stems below sparsely pilose. Leaves obovate-oblong, sharply, sometimes doubly, toothed, gashed or serrate and lower often lyrate or lobulate, lower or all narrowed into a petiole, always more or less hairy, often densely sericeous beneath. Flower heads yellow in oblong or corymbose, close or open, pubescent or sub-tomentose corymbs at the ends of all the upper branches. Involucre bracts linear or acuminate with scarious margins, more or less hairy, often glandular. Recept. glabrous. Cypsele grey-brown sub-angled, rarely faintly lined, minutely pubescent and glabrescent.

A common weed, growing on roadsides, waste-places, banks of rivers, etc. In all the districts. Fl., Fr. chiefly h.s.

Var. α. L. ell.-obovate attenuate at base, toothed or serrate, densely white silky beneath, about 2–3″ long on the stem, uppermost sessile smaller. Heads small ·2″ long.

Common.

Var. β. **Burmanni,** *F.B.I.*? Coarser, lower leaves lyrate-pinnatifid 4 by 2·5″. Heads large ·3″ long by ·2–·25″ broad (in fresh plant). L. hairy beneath slightly pubescent or sub glabrous above. Corolla ·17″ long with sessile glands.

Purneah! This may be *B. lactucæfolia, DC.* If it is it should be kept distinct under that name.

Var. λ. **glandulosa,** *DC.* Copiously pilose-glandular in addition to the other indumentum.

It is rather a form than a variety, such gland hairs being always more or less present.

Var. δ. **erianthoides.** Leaves 3″ scarcely lobulate or entire with the margins closely spinulose with small teeth of different sizes, silvery sericeous beneath. Upper part of plant sometimes almost dichotomous from the development of strong axillary branches.

Chota Nagpur! Fl. Feb.

This plant exactly matches with one from Bombay named at Kew *B. eriantha, DC.*, but if we discard the procumbent habit of *B. eriantha* (and the Bombay plant appears to have been erect) there is nothing left to separate it from *B. lacera*!

8. **B. laciniata,** *DC.*

A coarse strongly fœtid or aromatic (not camphoraceous) very erect green annual herb 2–4 ft. high with striate leafy stems with thin spreading hairs and stalked glands but often sub-tomentose upwards. Leaves 2·5–4·5″ (or the lowest sometimes nearly 6″, usually dry when the plant flowers), irregularly pinnatifid or sharply lobed or cut with the margins often undulate and sinuate, spinulose-toothed, those on the panicle sometimes small simple lobed or toothed, all pubescent hairy and glandular. Heads yellow long-pedicelled ovoid ·25″ long in large oblong or spreading panicles 4–10″ broad of very numerous branches from the leaf axils. Involucre bracts linear with green mid-rib

and scarious margins, outer very short and narrow, very glandular. Corolla ·15″ long, lobes short deltoid thinly ciliate and with sessile glands. Receptacle pubescent broad. Achenes ribbed hairy.

Banks and open places, biennial. Frequent. Patna (Wall No. 3085)! Manbhum. *Camp.*! Hazaribagh, *Clarke*! Bettiah! Neterhat (Palamau, elev. 3000)! Puri! Fl., Fr. March–Dec.

The above is the usual form. Small plants have the leaves much less cut and can then be distinguished from *B. lacera* by the indumentum, pubescent receptacle, and the ribbed achenes, and in the field especially by the smell, which is less pleasant in this plant. The pubescence on the receptacle is deciduous in fruit.

The ciliate or pubescent tips of the corolla occur also in specimens of *B. lacera* and are probably variable.

9. **B. Jacquemontii,** *Hook. f.*

Tall 2–3 ft. with stems stout below; closely resembling *B. virens* in its characters but much more villous and with larger heads. L. 3–5″ lower petioled, mostly deeply gashed or lyrate, uppermost quite sessile oblong, all sharply toothed and hairy. Panicles densely villous above. Heads ·25–·26″ long on divaricate pedicels, ·5–·7″ diam. when widely open in fruit, bracts rigid many-seriate less narrowly linear than in *B. virens* but lanceolate towards the ends, pubescent all over the back, usually purple, and without the very thin scarious margins of *B. virens*. Fruit much the same as in that species, 8–10-ribbed.

Top of Parasnath, *Clarke*, etc.! Neterhat!
Fl., Fr. April–May.

10. **B. virens,** *DC.* Syn. B. membranacea, *DC.*

An erect glabrous or thinly hairy and glandular herb varying from 1 ft. to 6 ft. in height and becoming woody below. Leaves very membranous, simple, obovate or lower deeply lobed or pinnatifid or lyrate, always with very sharp sometimes spinose teeth glabrous or very thinly hairy, lowest often attain 6″ (with the petiole) or only 3″, uppermost becoming very small and bractiform, subsessile, elliptic or lanceolate. Heads very many small, on slender divaricating pedicels ·2–·7″ long, in large panicles terminating all the upper branches. Involucre green or purplish, the bracts in many (about 4–5) series of which the outer are very short subulate and spreading (at least in fruit) and all, or the lower only, spinous pointed, longest linear about ·2″. Flowers yellow. Cypsele minute oblong ·03–·04″ distinctly ridged and with about 8 dark intermediate furrows, silky-pubescent and surmounted by a minute ring at top.

A species of moist banks and ravines in the forest at all elevations or of the higher mountains. Rather common. Purneah! Singbhum frequent! Ranchi and Palamau, ascends to Neterhat 3000 ft.! and Parasnath 4000 ft.! Hazaribagh, *Clarke*! Manbhum, *Campbell*! Angul (attains 6 ft. in ravines)! Fl., Fr. at various times.

B. virens is the glabrous form. *B. membranacea* is supposed to differ by being glandular and hairy, but all intermediates occur; the hairs are thin spreading villous or gland-tipped, never dense. One form has the upper invol. bracts tipped with a pencil of hairs, and generally the *B. virens* form has the bracts less spinose-tipped than *B. membranacea*. The heads (when fresh) are only ·2 rarely ·25″ long by ·1″ wide in flower. The pedicels often bracteolate.

Var. gracilis, *J.D.H.*

This form has the heads subsolitary or racemose on the slender branches, or

clustered on a simple stem. The leaves are membranous, sharply toothed and sub-lyrate green.

Parasnath! Cp. *B. atropurpurea.*

Var. **muralis,** *J.D.H.* Glandular hairy. Leaves elliptic-ovate or lanceolate toothed or serrulate, very membranous, involucral bracts rigid coloured purple like those of a *Vernonia.*

Palamau, *Gamble Herb.* The colouring is, however, not apparent in this specimen.

11. **B. flava,** *DC.* Syn. Laggera flava, *Benth.*; Moharenti, *Or.*

An erect herb 1–3 ft. high with amplexicaul irregularly toothed bright green glabrous, rarely scaberulous leaves, lower attaining 6″ by 2·5″, oblong with rounded auricles, upper sessile, hastate. Heads small bright yellow arranged in cymose leafless clusters on the branches, with campanulate shining green glabrous involucres.

Very common on clay soils in poor open forest in Chota Nagpur! Champaran! Angul to Sambalpur! Fl. Nov.-Jan.

Leaves often sharply dentate and denticulate. Heads often unisexual, very numerous, ·17–·25″ long. Bracts herbaceous, oblong, inner 1-nerved with hyaline tips or caudate. Receptacle flat, glabrous. Anthers sagittate, not tailed. Pedicels very slender. Cypsele very minute, glabrous. Pappus white.

11. PLUCHEA, *Cass.*

Tomentose or glutinous or glandular shrubs with alt. leaves and heads small in terminal leafless corymbs or large and subsolitary, heterogamous, disciform, white, yellow or lilac. Outer fls. filiform, fem. Inner few, herm. in form, barren, tubular, 5-fid. involucral bracts ovate, usually broad, dry, rigid. Anther bases sagittate, tailed. Cypsele 4–5-angled, small. Pappus hairs slender free or of the inner fls. connate.

1. **P. indica,** *Less.*

A low shrub, glabrous or nearly so except the pubescent corymbs. Leaves often gland-dotted, 1–2″ long, obovate or oblanceolate sub-serrate, narrowed into the short petiole. Heads ·25″ diam. with only 3 herm. fls. Involucral bracts many-seriate, outer with broad rounded tips, ·2″ long.

This shrub of the Sunderbans is only described as it may be found in the delta of the Mahanadi, which contains so many other Sunderbans plants and has been but very imperfectly botanised.

Fl. Jan.–March.

12. EPALTES, *Cass.*

Herbs with usually decurrent alternate leaves and small heterogamous disciform heads with numerous outer female filiform 2–3-toothed fls. and usually sterile centre 3–5-fid. fls. Involucre bracts many-seriate dry rigid. Anther bases sagittate with small tails. Cypsele 5–10-ribbed with no pappus in the female fl., usually abortive in the centre fls. with or without 2–3 caducous pappus hairs.

1. **E. divaricata,** *Cass.*

A glabrous annual herb with divaricate winged branches and linear, linear-oblong or lanceolate leaves 1–3″ long, narrowed at the base. Heads globose ·25″ diam. purplish, on winged peduncles. Involucral bracts sub-spinose at the tips, inner longer than the flowers. Cypsele ·02–·03″ long obovate-oblong.

Watery places, rice-fields, etc. Chilka Lake, *Alcock*! Fl. Oct.–Feb.

Much dichotomously branched. Leaves sometimes linear-oblanceolate and dis-

tinctly denticulate. Heads small with invol. bracts ·15–·24″ long dry sharp-pointed.

13. SPHÆRANTHUS, *L.*

Annual herbs with branches spreading from the root and alt. decurrent toothed leaves. Heads apparently large but consisting of many small heads sessile on a common receptacle and forming globose or ovoid clusters resembling single heads, clusters usually involucrate. Heads disciform heterogamous, outer fem. fls. few or many, slender, minutely 2–3-toothed, central fls. herm., fertile or sterile with thickened tube and 4–5-toothed limb. Invol. bracts narrow acute dry unequal. Anther-bases sagittate, auricles tailed or only acute. Style arms of herm. fl. filiform or connate. Cypsele oblong, sub-compressed. Pappus 0.

1. **S. indicus,** *L.* Syn. S. hirtus, *Willd.*; Mundi, *H.*; Murmuria, Ghork-mundi, *Beng.*; Murisa, Buikadam, *Or.*; Belaunja, *S.*

A viscous pubescent strongly scented herb with winged stems, sessile obovate or oblanceolate toothed leaves 1–2″ long and terminal and leaf-opposed compound magenta-coloured heads ·5–·75″ long; common receptacle elongated surrounded by many linear bracts with soft sub-spinous tips.

Wet places, rice-fields, etc. Common throughout the province. Fl., Fr. c.s. and until the habitat drys up.

Stems attaining 1 ft. or 18″ in length. Decurrent wings toothed and peduncles also with crisped or toothed wings. Fem. fl. with 2 linear style arms. Herm. fl. with tailed anther-cells and long subulate pubescent style.

The root is used as a stomachic and anthelmintic and the seeds have the same properties. The flowers are esteemed as alteratives and tonics, useful in skin diseases. *Nadkarni.*

14. ATHROISMA, *DC.*

An annual herb with alt., petioled pinnatifid leaves and small heads in globose or ovoid terminal peduncled clusters as in *Sphæranthus,* sessile on a common cylindrical receptacle without common involucre. Individual heads ovoid, receptacle furnished with broad dry pales enclosing the flowers and 1–2 invol. bracts like the pales. Outer fls. fem. very few, filiform, herm. fls. several with campanulate shortly 4-fid limb, anther-bases with connate acute auricles. Style arms of herm. fl. short flattened obtuse. Cypsele black, inner face flat, outer convex margin ciliate. Pappus of short stellately spreading finely fimbriate connate scales.

1. **A. laciniatum,** *DC.*

A viscid, glabrous papillose or pubescent herb with ascending branches 6–18″ long. Leaves few 1–2″ with oblong toothed segments. Clusters of heads white, ·5–1·5″ long.

Marshy places along the foot of the Rajmehal Hills, *Kurz.* Fl., Fr. April–May.

L. 1·5–2·5″ long with segments oblong toothed or sometimes coarsely-toothed or lobulate. Compound heads globose or ovoid-oblong ·25–·5 long on short clavate peduncles. Individual heads ovoid ·15″ with the broad pales very conspicuous and wrapping round the flowers as in many Helianthoideæ. Ray fls. very few (I do not find them in some heads). Herm. fls. corolla ·07″. Cypsele ·06″ trabeculate with shortly woolly margins.

15. GNAPHALIUM, *L.*

Hoary or woolly or green but cottony herbs with alt. entire leaves and small heads in terminal or axillary corymbs or fascicles, heterog., disciform. Outer fls. fem. filiform, 3–4-toothed, centre fls. fewer slender with 5-toothed limb. Involucr. ovoid or campanulate with many-seriate scarious bracts sometimes white, yellow or brown. Recept. naked or pitted. Anther cells with slender tails. Style arms of herm. fl. truncate or capitate. Cypsele oblong or obovoid not ribbed. Pappus hairs 1-seriate, caducous.

A. Heads in leafless corymbose clusters . . . . . 1. *luteo-album.*
B. Heads clustered, often leafy, never corymbose:—
1. Clusters numerous, axillary and terminal:—
a. Clusters often becoming spicate at the ends of the branches:—
Hds. usually spicate under ·1″ long. Pappus hairs free . 2. *indicum.*
Hds. over ·1″ long. Pappus hairs united at base . . . 3. *purpureum.*
b. Clusters very numerous small rounded, never spicate.
Densely woolly. Leaves under ·5″ long . . . . . 4. *pulvinatum.*
2. Clusters yellow subsolitary terminal subtended by short leaves. Heads minute . . . . . 5. *flaccidum.*

1. G. luteo-album, *L.*

A woolly herb branched from the root with branches 4–12″ long, the central usually erect, often corymbosely branched above. Leaves 1–2·7″ long oblong-spathulate or oblong-oblanceolate or upper linear-oblong, woolly on both surfaces, half-amplexicaul. Heads pretty, glistening golden-yellow, brown or whitish in dense terminal corymbs. Involucr. bracts oblong obtuse. Cypsele tubercled or with minute curved bristles.

Damp places, near rivers, etc. Nepal border, *Kurz*! Behar, *J.D.H.*! Ranchi, *Wood*! Singbhum, frequent! Fl., Fr. h.s.

The variety with golden-yellow heads and many stems is called var. *multiceps*. The commoner one with pale-brown heads, found probably in all districts, is called var. *pallidum* (Syn. *G. pallidum, Ham.*).

2. G. indicum, *L.*

A woolly or softly cottony herb with many stems spreading from the root or central one erect 4–8″ long. Leaves narrowly oblong or linear-obovate or spathulate apiculate ·5–·8″ in some forms, up to 2·5″ in another form. Heads ·1″ long or less in axillary clusters from the upper leaves and forming terminal spikes. Involucr. bracts erect linear-oblong or outer ovate-lanceolate, acute or obtuse, usually green below and shining yellow-brown above (which gives the colour to the head), longer ones ·08–·09″. Herm. corolla ·05–·06″. Cypsele minutely hispidulous. Pappus hairs free.

In rice fields, damp sands of river-beds, etc., throughout the area! Very common. Fl., Fr. c.s.

There appear to be two rather distinct forms:—

Var. *α.* Very woolly. Leaves under 1″ long. Spike elongated.
Var. *β.* Less woolly. Leaves up to 2·5″. Clusters more axillary. This passes into *G. purpureum.*

3. G. purpureum, *L.*

A herb, less cottony or woolly than the last with ascending stems 6–12″ high and narrowly spathulate leaves 1–2·5″ or (*teste F.B.I.*)

attaining 4″ long with broadly rounded, sometimes apiculate tip. Heads mostly in axillary clusters from the upper leaves, scarcely forming a spike, ·14″ long, outer bracts with sometimes acuminate tips, inner linear-oblong rounded ·12″ long. Herm. corolla ·07″ long, tip puberulous. Cypsele smooth or minutely papillose. Pappus hairs distinctly united at the extreme base.

Singbhum, Chaibassa! Fl. August.

4. **G. pulvinatum,** *Delile.*

A small very woolly plant with many stems spreading from the root 3–4″ long with small narrow spathulate leaves about ·25″ long only or less, much crowded above and small heads in clusters almost immersed in wool in their axils. Involucre bracts ·06–·08″ long, linear-lanceolate or linear, almost hyaline acute. Cypsele slender minutely papillose.

Damp ground. Bettiah, *Hieronymus*! Palamau, *Gamble*! Probably common. Fl., Fr. c.s.

5. **G. flaccidum,** *Kurz.*

A flaccid annual with simple erect flexuous stems or branching from the root, 4–6″ high, sparingly cottony. Leaves obovate-spathulate, 1–2″ long. Heads minute usually crowded into a single globose yellow cluster at the end of the stem or branches, cluster ·7–1″ diam. subtended by leaves shorter than itself. Inner bracts yellow glistening.

Very rare. Found near Maldah close to our area, *C. B. Clarke*! Fl. Feb.–March.

16. CÆSULIA, *Roxb.*

A glabrous herb with alternate narrow serrulate leaves and small one-flowered heads in axillary sessile involucrate globose clusters subtended by a common involucre, sessile on a broad convex common receptacle. Floret tubular and narrowly campanulate or salver-shaped, deeply 5-fid. Involucral bracts 2, opposite, keeled or winged, and at length adnate to and including the cypsele. Anther-bases with branched tails. Pollen spinose. Style branches short, very obtuse. Pappus 0.

1. **C. axillaris,** *Roxb.*

A small herb or with several stems attaining 15″, erect or sub-erect, with linear leaves 3–5″ long acute with thickened margin and numerous very oblique sec. n., base tapering into a very short petiole with dilated base embracing the clusters. Clusters also with usually two large involucral leaves adnate to the common receptacle. Clusters pearly-white when ripe with each flower (head) enclosed by two fleshy strongly compressed involucral bracts with a hyaline appendage. Anthers far exserted.

Marshy places, very common! All districts. Fl., Fr. Aug.–Jan.

17. INULA, *L.*

Herbs or shrubs with alternate leaves. Heads heterog., radiate or not. Outer fls. female, 1–many-seriate, yellow or white, 3-4-toothed,

with long, short, minute, or 0 ligule. Central fls. herm. tubular, yellow, tube slightly wider upwards, 5-toothed. Involucre bracts many-seriate, outer herbaceous, with the outermost often foliaceous. Recept. pitted or areolate. Anther bases with simple or branched tails, those of adjacent anthers sometimes connate. Style-arms of herm. fl. linear, broader upwards, obtuse. Cypsele usually ribbed. Pappus hairs rather short, 1–2-seriate, smooth scabrid or bearded.

1. **I. Cappa,** *DC.*

A stout shrub 3–4 ft. high with leaves white woolly beneath, denticulate with short mucronate teeth or some coarsely toothed. Heads ·3–·4″ long in close corymbs 2–4″ diam. Involucre ·2″ diam. at base slightly narrowed upwards with very many linear acuminate silky bracts. Florets very many deep yellow, ligules 0 (sometimes present in forms outside our area). Cypsele ·06″ silky. Pappus dirty white, hairs slightly thicker at the ends.

Sandstones of Ramnagar Hills, 1800 ft. and above! Fl., Fr. Oct.–Dec.
Stems white woolly. Leaves 4–6″ narrowly elliptic with an acute very sharply mucronate tip, lower petioled, uppermost sessile. Longer bracts ·2″. Herm. corollas ·22–·24″ long. Pappus ·2″.
Our plant described above differs in several details from the higher level form.

18. VICOA, *Cass.*

Herbs with alt. entire or toothed leaves, upper amplexicaul. Heads radiate and heterogamous or disciform and homogamous, solitary, terminal or on leaf-opposed peduncles. Ray fls., if present, 1–2-seriate, fem., 2–3-toothed. Disc fls. herm., slender, hardly dilated, 5-toothed. Involucre campanulate, bracts many-seriate, narrow, with scarious margins. Recept. without pales but margins of pits sometimes toothed. Anther bases with slender tails. Style arms of herm. fl. flattened, broader upwards, obtuse or truncate, quite smooth. Cypsele small, hardly ribbed. Pappus hairs 1-seriate, slender; of ray few or 0.

Very close to *Inula* and *Sir J. D. Hooker* says best united with it.

Pubescent or glabrescent. L. 3–4 times as long as broad. Involucre bracts not villous	1. *indica.*
Villous. L. 2–3 times as long as broad. Involucre bracts villous	2. *vestita.*

1. **V. indica,** *DC.* Syn. Inula indica, *L.*; V. auriculata, *Cass.*

A much branched rather rigid erect herb with slender stems and branches, 2–3 ft. high and somewhat reminding one of a Ragwort or Fleabane. Leaves sessile from a broad auricled base, narrow, 2–4″ long, acuminate papillose-pubescent and with small glistening glands beneath, sparsely hispidulous above. Heads solitary in large corymbose loose panicles at the top, yellow, ·8–1·2″ diam., with ligules ·2–·3″ long. Cypsele of herm. fl. brown terete hairy ·04″ long.

Very common in open jungles on clay soils in Chota Nagpur! Extending to Angul, Sambalpur and Kalahandi! Fl., Fr. Nov.–May.
Stems slender pale-brown smooth. Leaves entire or serrulate, somewhat rugose, sec. n. numerous oblique looped. Peduncles slender bracteate. Involuc. bracts outer short subulate, inner linear acuminate, all glandular. Receptacle deeply pitted with margins of pits slightly toothed and puberulous. Tails of adjacent anthers connate. Cypsele of ray flowers quite smooth and without pappus.

2. **V. vestita,** *Benth.*

A shorter stouter plant than the last, 6–15″ high, woolly and softly hairy, with oblong or linear-oblong obtuse or subacute serrate leaves 1–2″ long. Involucre bracts ·2″ with squarrose filiform recurved tips. Cypsele subsilky.

Banks of the Ganges, Santal Parganas, *Kurz*! Patna, *J.D.H.*! Bankipur! Bettiah, *Hieronymus*! Fl. March–May.

Stems sometimes purple corymbosely branched above but sometimes flowering when only 4″ high. L. half amplexicaul with broad subcordate base, villous rarely 2·5″ long. Peduncles 1·2″ villous. Heads solitary axillary and terminal ·6–·7″ diam. with linear ligules ·2″ long.

19. PULICARIA, *Gaertn.*

Herbs, usually woolly or villous, with alt. sessile, often amplexicaul leaves. Heads solitary radiate or disciform, yellow. Ray fl. if present, female, ligules narrow or minute or 0. Disc fls. herm., slender shortly 5-fid. Invol. hemispheric or obconic, bracts few-seriate, narrow acuminate or awned. Receptacle pitted. Anther-cells with capillary tails, simple or branched. Style-arms of herm.-fl. linear, obtuse. Cypsele smooth or ribbed. Pappus double, outer of short jagged teeth, inner of filiform or flattened hairs.

A. Pappus hairs deciduous leaving the scales :—
Heads ligulate. Cypsele glabrous. Root perennial . . . 1. *angustifolia.*
Heads disciform, homogamous. Cypsele hairy. Annual . . 2. *foliolosa.*
B. Pappus hairs thickened at the tips, connate with the scales and deciduous with them. Suffruticose :—
Heads ligulate. Cypsele nearly glabrous. Perennial . . . 3. *crispa.*

1. **P. angustifolia,** *DC.*

A herb with many diffuse or suberect pubescent branches 6–12″ long from a perennial rootstock, clothed with sessile linear or linear-oblanceolate, rarely somewhat obovate, toothed or entire leaves about 1″ long and gradually smaller upwards, becoming bractiform on the terminal peduncle. Heads bright yellow ·7–1·2″ diam. Invol. broadly campanulate, bracts linear to linear-oblong, ·2″ long, subequal erect and pubescent with slightly squarrose acute scarious tips. Ray fls. about 15–20, ·35–·4″ long. Pappus hairs slender pubescent slightly thicker upwards, as long as or exceeding the corolla tube, with an outer ring of minute scales. Cypseles pale-brown ·07″ hispid-puberulous, not ribbed.

Open places. Plateaux of Chota Nagpur :—Ranchi, *Clarke*! Neterhat! Fl., Fr. May–Oct.

L. sometimes all about ·5″, lower sometimes 1·5″, with a nerve parallel to midrib each side. Peduncles not thickened above. Corolla of disc flowers ·18″. Anthers long linear short-tailed.

2. **P. foliolosa,** *DC.*

A densely branched leafy annual 8″–2 ft. high, pubescent or tomentose but not white-cottony, with half-amplexicaul linear-oblong or oblanceolate leaves 1–2″, or lower up to 4″ long and spathulate-oblong. Heads very numerous, orange-red, lateral and terminal, ·25–·3″ diam. Invol.-bracts narrowly linear, glandular and sparsely pilose or ciliate. Ray fls. filiform tubular, ligules 0.

Banks of the Ganges, S.P., *Kurz*! Banks of the Ganges (without locality) *J.D.H.*! Fl., Fr. April-May.

Leaves more flaccid in texture than in the other species, entire, tips usually rounded. Peduncles very slender, often pilose or villous. Involucral bracts ·15″ glandular on the back.

3. **P. crispa,** *Benth.*

A suffruticose white-cottony herb 1–2 ft. high with half-amplexicaul linear, linear-oblong or somewhat oblanceolate crisped and toothed leaves ·5–2″ long decreasing in size on the peduncles, and heads of yellow flowers ·3–·5″ diam. Involucral bracts linear acute slightly pubescent. Ray fls. ligulate often shorter than the bracts. Cypsele oblong terete sparsely pilose. Pappus hairs barbellate and slightly thickened upwards, connate at the base with the outer ring of minute scales.

Banks of Ganges, Lucknow to Patna, *Madden*! Sone R., Deori, *J.D.H.*! Gya! Ganges Banks, S.P., *Kurz*! Fl., Fr. Jan.–April.

20. XANTHIUM, *L.*

Annual coarse rough herbs, unarmed or with 3-fid spines, alternate toothed or lobed leaves and 1-sexual, single or clustered axillary heads, males (herm. in form) in the upper axils. Involucre of female heads with the bracts united into an ovoid 2-celled utricle, each cell with a single apetalous flower with free style arms exserted from the utricle which has two beaks or horns. Male heads globose, many-fid. with short free 1–2-seriate narrow involucral bracts and cylindric receptacle with hyaline pales enclosing the flowers. Corolla tubular 5-toothed, filaments monadelphous but anthers free with obtuse bases and inflexed mucronate tips, ovary sterile, style simple. Cypsele (of fem. fl.) enclosed in the hardened cells of the utricle; pappus 0.

An interesting genus, not always at once recognisable as a Composite in fruit; the peculiar involucre simulating a two-celled ovary.

1. **X. strumarium,** *L.* Chhota-gokhru, *Vern.*

A herb 1–3 ft. high with closely hispidulous or strigillose stems and long-petioled ovate-triangular coarsely lobed and toothed leaves 2–4″ long with the base often cordate and cuneate on the petiole, strongly 3-nerved. Fem. involucres burr-like, ·5–1″ long closely covered with hooked spines, male heads at the top of the inflorescence or stem ·25″ diam. with prominent exserted anthers.

Waste ground, especially near river-beds. In most districts but only locally abundant! Fl., Fr. c.s. Fr. h.s.

Leaves scabrid or hispid. Petiole often exceeding the blade. Stem not armed in our species but in an allied species *X. spinosum*, L., recently introduced (*fide Prain*) into Bengal, and likely to spread into our area; it is armed with 3-fid spines.

21. SIEGESBECKIA, *L.*

Glandular-pubescent herbs with opposite toothed leaves. Heads heterogamous small, loosely panicled with usually 5 outer glandular involucral bracts different from the inner ones. Outer female flowers enclosed by invol. bracts 1-seriate, scarcely radiate, tube short, limb 2–3-fid. Disc fls. herm. fertile or inner sterile, tubular with campanulate 5-fid limb or narrow and 3–4-toothed. Receptacle with

membranous concave pales often enclosing the flowers. Style arms of herm. fl. short flattened subacute. Cypsele obovoid-oblong, not compressed, obtuse. Pappus 0.

1. **S. orientalis,** *L.*

A branched rather coarse annual 2–5 ft. high with pubescent stems, opp. ovate coarsely crenate, softly pubescent leaves with the blade decurrent on the petiole, larger 7″ by 3″, upper gradually smaller. Heads very small yellow, easily recognised by the 5 long outer linear-spathulate glandular invol. bracts and the inner embracing the flowers and black cypseles.

Common in somewhat damp localities under shade :—Chota Nagpur! probably in all districts. Fl., Fr. c.s.
Leaves 3-nerved. Outer fls. few. ligulate, 3-toothed. Inner with apiculate anthers.

22. ENHYDRA, *Lour.*

Marsh herbs with opposite sessile sometimes gland-punctate leaves and axillary subsessile heads terminal, unilateral or in alternate axils, heterogamous, sub-radiate. Ray fls. fem. many-seriate with minute broad 3–4-toothed ligule. Disc fls. herm. fertile or inner sterile, 5-fid. Invol. bracts 4 foliaceous and sometimes petaloid in opposite pairs. Recept. with pales enclosing the flowers, tipped with glandular hairs. Anther bases obtuse. Style arms of herm. fl. flattened oblong obtuse, tips hispid. Cypsele oblong, enclosed in the rigid pales, outer dorsally, inner sometimes laterally compressed. Pappus 0.

1. **E. fluctuans,** *Lour.* Harhuch, *H.*; Hingeha, *Beng.*

Stems prostrate rooting at the nodes, succulent, with short ascending flowering hairy branches and flowers in yellow heads, the four greenish-yellow involucral bracts or leaves giving the heads the appearance of single flowers.

River-beds, Ranchi, 2000 ft.! Fl., Fr. Dec.–Jan.
Leaves narrowly oblong 1–2″ serrate, gland punctate beneath. Heads terminal and axillary sessile, ·3–·7″ diam. Corolla of ray-flower 3-lobed to one side.

23. ECLIPTA, *L.*

Strigose or hirsute herbs with opposite leaves and small peduncled axillary or terminal heterogamous rayed heads. Invol. broadly campanulate with bracts 3-seriate, outer herbaceous, large and broad. Ray fls. fem. sub-2-seriate, fertile or sterile, with small entire or 2-toothed white (rarely yellow) ligule. Disc fls. with broad-campanulate 4–5-fid limb. Receptacle flat, outer pales narrow, flat,* inner narrow filiform* or 0. Anther bases obtuse. Style-arms flattened with short or triangular obtuse appendages. Cypsele of ray narrow, 3-quetrous, often barren; of disc stouter, laterally sub-compressed. Pappus of teeth or 2-aristate or obsolete.

* The *F.B.I.*, following the *Genera Plantarum*, states that the pales enclose several flowers. I do not find this. Even if the third series of bracts be regarded as pales, these are narrow and flat and do not enclose any fls.

1. **E. alba,** *Hassk.* Mochraud, bhangra, bengraya, babri, *H.*; Kesari, Kesuti, *Beng.*; Hatu kesari, *K.*; Kesarda, *Or.*

A diffuse or erect usually much branched weed, frequently rooting at the lower nodes, strigillose hispid or hirsute all over with the hairs rising from a thickened base (best seen when dry). Leaves short petioled subentire or toothed, usually oblong or elliptic. Heads subglobose ·17–·35″ diam, outer flowers with a narrow white ligule. Peduncles very short (in all the specimens from our area, but sometimes long and slender), sometimes paired. Involucral bracts ovate acute or obtuse, strigose. Pales mostly filiform with slightly dilated shortly hairy tips. Cypsele ·1″ long, 2-edged, verrucose on the flatter faces or all over, tip hairy, pappus obsolete or of 2 short awns or teeth.

Common in pasture lands, roadsides, etc., in Chota Nagpur! Probably in all districts of the province. Fl., Fr. Aug.–Feb. and perhaps throughout the year.

Leaves very variable, only ·5–·8″ in some decumbent specimens, 2–4″ in others, tapering into a very short petiole, tip acute or acuminate. Involucre bracts strongly 3-more nerved, inner (or outer pales?) 1-nerved. Disc flowers with campanulate limb exceeding the short narrow tube.

The plant is used in Hindu medicine for various purposes, among others for scorpion stings.

24. BLAINVILLEA, *Cass.*

Scabrid or villous herbs with leaves opposite, or upper alternate, petioled, toothed. Heads small, subsessile or peduncled, heterogamous, radiate or subdisciform, white or yellow. Ray fls. with small 2–3-toothed or 0 ligules. Disc fls. tubular with dilated 5-fid limb. Involucral bracts few, outer herbaceous, inner passing into the membranous concave or conduplicate pales of the small convex receptacle. Style-arms of herm.-fl. narrow flattened with acute or sub-obtuse appendages. Cypsele truncate, of ray fls. 3-quetrous or dorsally compressed, of the disc 3–4 angled or laterally compressed. Pappus of 2–5 unequal bristles connate at base.

1. **B. latifolia,** *DC.* Syn. *B. rhomboidea, Cass.*

An erect somewhat coarse herb with straw-coloured hispid-pubescent stems much branched above, 1–3 ft. high, or 3–4 ft. in rich soil. L. opp. or upper alt. 1–4″, ovate or upper ovate-lanceolate, with cuneate base, coarsely serrate or crenate-serrate, hairy both sides. Heads white ·12–·2″ in flower enlarging to ·3–·4″ in fruit, solitary in the forks and subcorymbose at the top of the branches. Involucral bracts 2-seriate, outer 5 oblong acute ·25″ long in fruit. Inner cypseles embraced by the fimbriate or toothed pales which overlap them. Pappus of 3 bristles or 3 hairy scales.

A common weed throughout the area. Fl., Fr. Sept.–Jan. Annual.

Leaves 3-nerved at the base. Petiole of lower leaves often 1′ long, upper shorter. Peduncles hardly any, then often elongating to 1–2″. Outer (ray) fls. few with long tube and minute obovate notched ligule, style with slender arms. Disc fls. with black anthers and flattened style arms. Outer layer of cells of the cypsele often golden yellow, margins and angles slightly pubescent.

25. WEDELIA, *Jacq.*

Herbs or suffruticose with opposite leaves and axillary or terminal radiate heads with yellow entire or 2 3-toothed ligules. Involucre

with sub-2-seriate bracts, outer 3–5 usually herbaceous or foliaceous, pales of receptacle embracing the flowers. Disc flowers tubular broader upwards, 5-toothed. Style-arms flat, linear with hairy or pubescent margins and acute tips. Cypseles of disc obovoid or cuneate-oblong with rounded top, if laterally compressed then edges rounded, smooth or tubercled or scabrid on top. Pappus of minute scales with occasionally one or few bristles added, or 0.

A. Erect or procumbent herbs.
Stems creeping below. Hds. ·9–1·3″ diam. . . . . 1. *calendulacea.*
Erect or sub-erect. Hds. ·3–·4″ diam. . . . . 2. *Wallichii.*
B. Scandent. Shrubby. Hds. ·75–1″ diam. . . . . 3. *scandens.*

1. **W. calendulacea,** *Less.* Kesaraja, *Beng.*; Bhanra, *H.*

A bright little plant with stems creeping below often for 1–2 ft. with erect branches, oblong or lanceolate-oblong leaves 2–3″ long narrowed into the subsessile base and bright yellow flowers ·9–1·3″ diam. at the ends of long peduncles from the upper leaf-axils.

Watery places Fl., Fr. March–Sept.

Stems thinly strigose or glabrate. Leaves subentire, crenate or with large serratures, sparsely strigose both sides. Involucre campanulate with broad oblong bracts spreading above. Ligules about 8, narrowly 3-lobed or -toothed. Corolla lobes of disc fls. ciliolate. Pappus a denticulate cup.

The vernacular names of this plant and *Eclipta alba* are confused, and whereas *Datt* gives this as the plant chiefly used in medicine, *Nadkarni* gives *Eclipta*. Both plants appear to be considered tonic and alterative and useful in cough, skin diseases and alopecia. There is no similarity in the plants themselves.

2. **W. Wallichii,** *Less.*

An erect or suberect herb 6″ to 2 ft. high with hispid pubescent stems, flaccid ovate or ovate-lanceolate crenate-serrate acuminate leaves 1–4″ long and yellow shortly-peduncled terminal and leaf-opposed heads ·3–·4″ diam. Outer invol. bracts calyciform, 4–5, imbricate ·2–·25″ long oblong acute, each subtending a ray flower, inner narrower. Disc fls. 4–7 only, each subtended by a conduplicate nerved linear-lanceolate pale. Cypsele brown ·14″ obovoid, scarcely compressed top hispid. Pappus a very short scaly or toothed ciliate ring.

Among grass on the top of Parasnath, 4000 ft.! Fl., Fr. Oct.–Dec.

Leaves 3-nerved above base, hairs scattered, white, often appressed, suddenly narrowly cuneate on the ·5–·75″ long slender petiole. Peduncles ·5–1″ long. Ligules about as long as involucre, pubescent below as is the ovary, ·1″ broad above. Corolla of disc fls. pale, anthers black, minutely tailed, style arms spreading and recurved slightly dilated above and subobtuse, yellow.

3. **W. scandens,** *Clarke.* Syn. W. biflora, *DC.*

A large suffruticose climber with ovate acuminate serrate petioled leaves which are 3-nerved. Invol. bracts oblong or ovate-lanceolate often recurved, inner bracts subobtuse. Cypsele 3–4-angled, rough tip broadly truncate.

This shrub, which is found in the Sunderbans and extends down the East coast, is likely to be found in the Mahanadi Delta.

26. SPILANTHES, *L.*

Herbs with opposite leaves. Heads radiate or not, ligules yellow or white, 2-lobed. Involucre ovoid or campanulate, bracts sub-2-

seriate. Receptacle very conical and elongate with paleæ which embrace the flowers. Disc fls. tubular with a spreading 4–5-fid limb. Style arms of disc-fls. truncate, sometimes dilated at the tip. Cypsele of disc usually laterally compressed. Pappus 0 or of 2–3 bristles.

1. **S. acmella,** *L.*

A herb with long weak stems creeping at the base, sometimes 2–4 ft. long, or erect or ascending, ovate or lanceolate-serrate leaves 1·5–2″ long and pretty yellow heads ·5″ diam. with very prominent centre, on long terminal peduncles.

Watery places, not common. Fl. Sept.–Dec. and perhaps at other times.

Var. *α.* **typica.**

Leaves often coarsely toothed. Cypsele prominently hispidly ciliate on the prominent margins and sometimes the faces shortly hairy.

Sameshwar Hills, N. Champaran! Chota Nagpur. *Wood* (precise locality not noted)! Manbhum, *Ball*! Santal Parg., *Kurz*!

Var. *β.* **calva.**

Stems long often red and villous above, leaves serrate, ligules 2-fid. Cypsele of disc 2-edged black and shining and completely glabrous, outer 3-angled.

Neterhat, elev. 3000 ft.!

The involucre bracts in var. *calva* are lanceolate, ·12″ long, those of the type often shorter and more ovate. The creeping form superficially resembles *Wedelia calendulacea* before the receptacle elongates.

27. HELIANTHUS.

Herbs, often very large, with opp. or alt. coarse leaves and medium to very large radiate heads, solitary or in loose corymbs. Involucre hemispherical or very broad, bracts 2-many-seriate, outer at times with foliaceous tips. Ray flowers neuter (and occasionally in cultivation all the disc flowers become ligulate). Cypsele thick, slightly compressed or 4-angled. Pappus of 2 deciduous awns sometimes with a caducous bristle between them, or of two large dry scales.

A large North American genus.

Annuals.
- Leaves and stems hispidly hairy . . . . . 1. *annuus.*
- Leaves and stems softly cottony . . . . . 2. *argyrophyllus.*

Perennial, with tuberous roots . . . . . 3. *tuberosus.*

1. **H. annuus,** *L.* Surajmukhi, *Vern.*; The Sunflower.

This, the common Sunflower, is often cultivated. The seeds give an oil and are also used as a food for poultry.

2. **H. argyrophyllus,** *Torr. & Gr.* Safed Surajmukhi, *Vern.*

Cultivated and frequently self-sown near houses. *Prain* calls it the "Rains Sunflower."

3. **H. tuberosus,** *L.* Brahmokha, *Vern.*; The Jerusalem Artichoke.

A well-known plant resembling a sunflower in leaf. Widely cultivated.

The genus **Tithonia** is allied. The heads are large on clavate peduncles. Pappus 0 or of many scales with or without 1–2 caducous

bristles. The flowers are often red and handsome. *T. tagetiflora, Desf.*, is common in gardens.

28. GUIZOTIA, *Cass.*

Herbs (natives of Africa) with leaves opposite, or upper alternate, and axillary and terminal rather large peduncled rayed yellow heads. Involucampanulate with the outer bracts herbaceous or almost foliaceous, the inner paleaceous. Pales of recept. embracing the fls. Corolla villous at the base, the lower hairs reflexed and covering the top of the hypanthium. Cypsele of ray fls. 3-, of herm. fls. 4-angled. Pappus 0.

1. **G. abyssynica,** *Cass.* Syn. Verbesina sativa, *Roxb.*; Gunja, *Beng.*; Ramtila, *H.*; Sarguja, *K.*

A leafy herb forming in cultivation beautiful golden-yellow crops. Stem slightly hairy. Leaves opposite sessile and half-amplexicaul, 3–5″, linear oblong or lanceolate, serrate. Heads ·5–1″ diam. on peduncles 1–2″ long. Ovary tipped with a ring of hairs and the hairy base of the corolla.

A very common crop in Chota Nagpur and the uplands of Orissa! Also cultivated to a less extent in the Northern Area. Fl., Fr. Nov.–Dec.

The seeds yield an oil used as an article of food. They are also ground into flour, of which cakes are made. They are smooth, of a blackish brown colour, somewhat obovate with the angles rounded.

29. BIDENS, *L.*

Herbs with opposite entire or divided leaves. Heads rayed, or disciform and then homogamous. Ray fl. fem. or neuter with white or yellow ligule. Involucral bracts sub-2-seriate with connate bases, outer herbaceous, inner membranous, pales of recept. narrow, nearly flat. Style-arms of herm. fl. hairy above with a short appendage. Cypseles 4-gonous or dorsally compressed, linear or cuneiform, often narrowed but not beaked above. Pappus of 2–4 retrorsely hispid bristles, rarely 0.

1. **B. pilosa,** *L.*

Usually a tall herb 2–4 ft. high with opp. 3-foliolate or pinnate or 1–2-pinnatifid leaves and long-peduncled heads of yellow disc fls. and 5–7 white ray flowers, or the ray fls. sometimes absent. Easily recognised by its angular slender black cypseles ·5–·7″ long with 2–4 rigid awns with retrorse bristles by which they adhere to the clothes.

Chiefly in the damper or higher districts Purneah! Chota Nagpur, all districts, especially at the higher elevations! Fl. Sept.–Dec. Fr. Nov.–Jan.

Stems striate, glabrous (in our area). Lflts. ·5–2″ long, ovate or lanceolate, serrate. Heads very variable, the ray ligules sometimes ·75″ broad, white (in our specimens, sometimes said to be yellow), at other times evanescent. Involucral bracts with broad scarious margins and receptacle covered with brown-nerved pales with scarious margins. Heads at first only ·2″ long, elongating in fruit and the pales becoming longer than the involucral bracts. Awns pale.

30. COSMOS, *Cav.*

Herbs often with showy flowers closely allied to *Bidens* and distinguished from that genus by the purple or rosy neuter ray flowers, more rarely white or yellow, and the beaked cypseles which are very elongated when ripe. An American genus.

A. Leaf segments not filiform :—
Flowers rosy, pink or purple . . . . . 1. *caudatus.*
Flowers yellow . . . . . 2. *sulphureus.*
B. Leaf segments filiform. Flowers bright red or purple . . . 3. *bipinnatus.*

1. C. caudatus, *H.B.K.*

A herb 1–3 ft. high with pinnate leaves, the pinnæ pinnatifid and cut, ultimate lobes lanceolate or oblanceolate, very acute. Flowers of ray mostly pink, ligule faintly 3-toothed, the central florets yellow. Outer involucral bracts with hispid margins. Cypsele very slender with a beak as long as itself, together 1·2″ long, beak hispid with two slender awns.

Semi-wild in the Santal Parganas. Fl., Fr. c.s.
Branches sulcate glabrous or with few hairs, peduncles puberulous.

2. C. sulphureus, *Cav.*

A rather coarse herb, 2–3 or sometimes 5 ft. high with sulcate hairy stems. Leaves much as in last with pinnules decurrent ovate acute, or ultimate longer and lanceolate. Involucral bracts of both series 8 (as in last), lanceolate acute, outer series spreading shorter (*Cavanille's* fig. shows them subequal, specimens at Kew much shorter !). Corolla deep yellow, ray fls. 8 with sharply 3-toothed ligules. Cypsele as in last.

Native of Mexico. Common in gardens and often running wild. The last described plant may belong to *C. sulphureus*, as the outer bracts are much smaller than the inner, whereas in true *C. caudatus* they are a little longer !

3. **C. bipinnatus,** *Cav.* The well-known garden plant with finely divided foliage and pink, purple or white flowers.

31. GLOSSOGYNE, *Cass.*

Perennial herbs with leaves chiefly from the rootstock and only a few alternate ones on the stems. Leaves usually 1–2-pinnatifid. Closely allied to *Bidens*, from which it chiefly differs in the long subulate acute papillose stigmas or style-arms.* The outer involucral bracts are only slightly connate at the base. Ray fls. female or neuter. Cypsele with 2 retrorsely hispid awns, truncate.

1. G. pinnatifida, *DC.*

A herb with numerous stems from a very woody rootstock and sub-pinnate or twice pinnatifid leaves 1–3″ long with linear or linear-cuneate acute segments. Flowering stems 4–10″ high, nearly naked, cymosely branched, heads terminal, ·2″ long and broad in flower,

* Under a high magnification the style arms themselves are seen to be very short and glabrous, and these stigmas are therefore usually described as *appendages* to the style arms. In *Bidens* the "appendages are" very short oblong with rounded tip and papillose on the edges.

ligules whitish with dark veins, about ·1″ broad. Cypsele linear sulcate ·3″ long with the awns widely spreading when ripe.

Plateaux of Chota Nagpur! Fl., Fr. April–Nov. It usually flowers after the firing of the grass lands in which it is found.

32. GLOSSOCARDIA, *Cass.*

A small herb with alt. slender 1–2-pinnatisect leaves. Heads small terminal and axillary, rayed, yellow. Ray fls. usually one only with 2-fid ligule, female. Disc fls. herm., few fertile, 4-fid. Involoblong with few bracts, inner oblong with broad membranous margins. Pales on receptacle flat. Style-arms of herm. with linear acute hispid tips. Cypsele narrowly oblong, dorsally much compressed, faces bearded. Pappus of 2 smooth stiff awns.

1. **G. linearifolia,** *Cass.*

A curious little plant 1-6″, rarely 10″ high, branched, glabrous with the leaves cut into linear segments and somewhat shining oblong heads ·3″ long remarkable for the few large oblong black 2-horned cypseles, very hairy on the faces.

Chiefly amongst rocks. Singbhum! Ranchi! Fl., Fr. Sept.-Oct. It is also found in the Central Provinces and will probably therefore be found in other of the western districts.

The involucral bracts spread after the fall of the cypseles.

33. CHRYSANTHELLUM, *Rich.*

Annual glabrous herbs with alternate pinnatifid or radical toothed leaves. Hds. small, rayed. Ray fls. fem. 1-seriate with spreading yellow ligule. Disc fls. herm. with very short tube and a campanulate 5-lobed limb. Recept. flat with narrow scarious pales. Style-arms of herm fl. with long subulate arms. Cypsele oblong or linear-oblong, dorsally compressed, outer sometimes tubercled, thick with obtuse margins, inner smooth flat margined or 2-winged. Pappus a minute corona or 0.

1. **C. indicum,** *DC.*

Stems numerous spreading and procumbent, branched and leafy, from 3″ in some cases to 1 ft. long. Leaves ·5–2″, rarely 3″ long, deltoid, 2-pinnatifid, final segments broadly linear or cuneate. Heads peduncled ·15–·2″ diam. in flower, ·25–·3″ in fruit, with the invol. bracts widely spreading, nerved, oblong with rounded or apiculate tips, golden yellow. Cypseles ·1″ long, outer thick corky umbonate sub-compressed, 3-grooved on each face, inner (strongly resembling the mericarp of an Umbellifer) somewhat obovate, compressed, ridged on each face and with lighter-coloured margins.

Common on banks, open pasture, etc., in Chota Nagpur! Behar, *Bengal Plants.* Fl., Fr. Sept.–Dec.

34. TRIDAX, *L.*

Herbs with opposite toothed, lobed or pinnatisect leaves. Heads on very long peduncles, rayed. Ray fls. fem. ligulate or 2-lipped with the outer lip large 3-fid or -partite, the inner small 2-lobed or -parted or 0. Disc. fls. herm. tubular, slightly wider upwards, 5-lobed.

Involucre bracts few-seriate, outer short broad herbaceous, pales membranous. Anther-bases with short acute auricles. Style-arms of herm. fl. hairy above with subulate tips. Cypsele turbinate or oblong, silky. Pappus of aristate feathery bristles.

1. **T. procumbens,** *L.*

Stems usually several procumbent hairy, attaining 18″ in length with ascending tips and very long erect peduncles. Leaves in rather distant pairs, 1–2″ long, coarsely toothed or lobed, lobes serrate, both sides hairy, petioles short. Peduncles sometimes 12″ long. Heads ·3–·5″ diam. in flower, ·75″ in fruit. Involucre hirsute ·25″ long. Ray fls. with a slender hairy tube and spreading deeply 3-lobed ligule ·1–·15″ long. Cypsele black densely hairy or silky, pappus of ray fls. ·13″, of disc fld. fls. longer.

Abundant in pastures, banks and waste ground in Chota Nagpur and south to Kalahandi! Probably in all districts. Introduced from South America. Fl., Fr. all the year round.

35. FLAVERIA, *Juss.*

Herbs with opposite leaves and yellow flowers formed into close clusters of heads resembling single heads. Individual or simple heads small 1–5-fld. homogamous or with 1 very shortly ligulate female, involucre of 2–4 bracts with sometimes 1–2 outer scales. Receptacle naked. Style of herm. fl. with truncate arms. Cypsele narrow, 8–10-ribbed. Pappus 0.

1. **F. repanda,** *La Gasca.* Syn. F. contrayerba, *Flora of Bombay*; F. australasica, *Flora of Madras.*

An erect glabrous often 2-chotomously branched herb varying much in stature from 8″ to 2 ft. with opp. or pseudo-verticillate linear-lanceolate, lanc., or oblanceolate, rarely ell.-lanceolate, 3-nerved leaves 1–2″ long, tapering into a slender petiole which is again dilated at the amplexicaul base or those subtending the heads sessile with dilated base. Compound heads ·3–·5″ diam. globosely fasciculate, involucrate, axillary, subtended by a leaf (see above) and several bracts equalling or exceeding the head.

Watery places, occasional. Fl., Fr. Sept.–Jan.

There seems to be a difference of opinion as to the name of this plant. The cypseles in our species are grey-black, ·1″ long with about 10-12 black fine distinct ridges and are enclosed in the two proper bracts of the simple heads, which are connivent, ·18–·2″ long. *F. contrayerba, Pers.*, differs by the usually larger leaves and far more loosely compound heads (sometimes becoming distinctly branched). *F. australasica, Hook.*, also has somewhat larger leaves and its cypseles are longer, viz. ·14″ long with stronger ridges, but the plant would appear to be little more than a variety. The two former are natives of Central America and the last a native of the interior of Australia.

36. TAGETES, *L.*

Herbs, often gland-punctate, with opposite pinnatisect, rarely subentire, serrulate leaves. Heads orange with 1-seriate (rarely 0) fem. ligulate ray fls., disc fls. 2-sexual with 5-fid corolla. Involucre-bracts 1-seriate more or less connate into a campanulate or cylindric cup. Receptacle fimbrillate. Anther-bases obtuse. Style of disc fls.

with slender truncate and penicillate or shortly appendaged arms. Cypsele linear, compressed or angular, base attenuate with conspicuous basilar callus. Pappus of few (usually 5–6) scales, sometimes aristate.

1. **T. patula,** *L.* Genda, Gendu, *Vern.*

Erect. Leaf segments linear-lanc. with more or less spinulous serratures. Heads solitary long-peduncled. Involl. glabrous. Corolla golden to tawny.

Banks of the Ganges, *Kurz*! Cultivated in all Indian gardens. Native of Mexico. Fl. chiefly r.s.

37. COTULA, *L.*

Small herbs with alt. pinnatifid or pinnatisect, rarely only toothed or entire leaves. Heads small, peduncled, yellow, disciform. Outer fls. fem. 1–2-seriate, corolla conic or 0. Centre fls. herm., tube slender or stout and 2-winged, limb 4-fid. Involl.-bracts sub-2-seriate, margins often scarious, receptacle naked. Anther-bases entire. Style-arms of herm. fl. truncate or obtuse. Cypsele of the ray or all stipitate, compressed, sometimes sheathed at top by the base of the corolla, at others with a short ear-shaped pappus.

Leaves with acute lobes. Outer cypseles alate or margins thickened	1. *anthemoides.*
Leaves with spinule-tipped lobes. Cypseles small angled, not alate	2. *hemispherica.*

1. **C. anthemoides,** *L.*

A small prostrate herb with leaves 1–2-pinnatifid or 1–2-pinnatisect, ·3–·75″ long, segments with lanceolate lobes. Peduncles often very slender. Outer cypseles broad flat with winged margins, often much thickened.

Gangetic Plain from Rajmahal (Santal Parganas) westwards (*fide F.B.I.*). Fl., Fr. Feb.–March.

2. **C. hemispherica,** *Wall.*

A small suberect, prostrate or diffuse herb with many stems 3–8″ long often thickened below, glabrous or villous above, with pinnatisect leaves ·5–2″, segments linear spinulose or with 2–3 spinulose or mucronate teeth towards the ends, uppermost leaves simple. Heads small yellow solitary peduncled, ·17″ diam. on short peduncles, erect in flower, inclined or drooping in fruit. Outer fls. minute with 2-toothed or 0 corolla. Cypseles angled, not winged.

Along river banks. Purneah, *Kurz*! Fl., Fr. Jan.–April.

Both are rather pretty little plants with *Anthemis*-like foliage. This has leaves more finely cut than in *C. anthemoides* with rather wide rhachis.

38. CENTIPEDA, *Lour.*

Herbs with alt., often toothed leaves and small heads sessile on the branches or racemose, disciform, yellow or pale grey. Outer fls. fem., many-seriate with minute obscurely-lobed corolla. Centre fls. few herm. with short tube and campanulate 4-fid limb. Involl. bracts

2-seriate, spreading in fruit, receptacle naked. Style-arm of herm. fl. short truncate. Cypseles 4-angled obtuse, angles hairy. Pappus 0.

1. C. orbicularis, *Lour.*

A small prostrate herb with very numerous branched stems spreading from the root. Leaves ·3–·75″ long or less, oblanceolate or obovate-oblong coarsely toothed. Heads inconspicuous sessile or subsessile globose ·1–·12″ diam., receptacle marked with the small elevated seats of the flowers after fall of the minute sharply 4-angled cypseles which are only ·018″ long.

In muddy places or damp ground. Singbhum and Ranchi, common! Lohardagga, *Gamble*, *Clarke*! Santal Parg., *Kurz*! Purneah! Sambalpur! Doubtless in all districts. Fl., Fr. March–Jan., probably all the year round where moist conditions favour it.

The habit of the little plants of the genera *Grangea*, *Cotula*, *Centipeda* and *Sphæromorphæa* are very similar. *Sir J. D. Hooker* states that *Centipeda* and *Sphæromorphæa* should be placed near *Grangea*, *i. e.* in the Asteroideæ; *Cotula* also seems closely allied to *Grangea*, both having stipitate cypseles.

39. SPHÆROMORPHÆA, *DC.*

A small perennial, pubescent with crisped hairs, with prostrate branches, and alt. sessile leaves. Heads axillary, subsolitary, shortly peduncled, disciform, yellow. Outer fls. female, many-seriate, corolla elongate slender tubular, inflated below. Centre fls. herm. fewer, fertile tubular, 4-cleft. Involucr. bracts many-seriate, oblong, obtuse, coriaceous, incurved in fruit. Style arms 2-fid. Cypsele subcylindric, slender, broadly ribbed, hairy at the base only. Pappus 0.

1. S. Russeliana, *DC.*

Root stout woody with woody straggling prostrate flexuous branches 6–8″ long and obovate or oblanceolate obtuse toothed leaves ·25–1″ long narrowed into a very short petiole, gland-dotted beneath. Heads sometimes paired, ·15–·2″ diam. globose. Involucr. bracts broadly oblong or obovate obtuse, closing over the head in fruit, not spreading as in *Centipeda*.

In fields. Manbhum, *Camp.*! Giridih, *Prain*! Orissa, *fide Bengal Plants* (but I have seen no Orissa specimens; *Russell's* plant was collected in the Circars). Fl., Fr. May.

40. ARTEMISIA, *L.*

Herbs or shrubs, usually strong-scented, with alt. entire, serrate or 1–3-pinnatisect leaves and small usually panicled, sometimes solitary or fascicled, homogamous or heterogamous disciform heads. Outer fls. usually female, 1-seriate, very slender 2–3-toothed. Inner fls. herm., sometimes sterile, 5-fid. Involucr. bracts few-seriate, outer shorter, margins scarious. Recept. naked or hirsute. Anther bases obtuse. Style arms of herm. fl. with truncate usually penicillate tips, in the sterile flower often connate or connate with disciform top. Cypsele very minute, faintly striate. Pappus 0.

Inner fls. sterile. Leaves simple or coarsely toothed	1. *parviflora*.
Inner fls. fertile. Leaves multifid	2. *caruifolia*.

1. **A. parviflora,** *Roxb.*

A suffruticose herb 3 ft. high with erect rather strict stems tomentose or hairy above and often ridged or grooved. Leaves sessile linear-cuneate, linear, or oblanceolate usually acutely lobed or with long deep serratures towards the apex, upper often entire; all usually with narrow stipule-like appendages. Heads yellowish-green subglobose ·1″ long only, secund in elongate strict panicled racemes. Herm. fls. about 6–12, sterile, with tip of entire style dilated and anthers with very acute acuminate or aristulate tips. Involucre bracts broadly oblong with broad scarious margins.

Ranchi and Palamau, Neterhat, 3000 ft.! Parasnath 4000 ft.! Fl. Sept.–Nov. Fr. Dec.–Jan.

Inodorous. Leaves 1–2·5″ long, sub-flabellately 3-nerved, tip sometimes very acutely 3–5-fid. Style of fem. fl. with 2 linear arms.

2. **A. caruifolia,** *Ham.*

An erect herb 2–4 ft. high with smooth striate rather stout herbaceous stems and multifid leaves with very narrow weak segments. Heads globose drooping ·12″ diam. in secund axillary leafy racemes. Involucre bracts oval to oblong with broad scarious margins or outer with narrow margins. Centre (herm.) fls. fertile. Receptacle swollen, glabrous.

Purneah and Northern Santal Parg., near Sahebganj, *Kurz*! Fl. March–April.

41. EMILIA, *Cass.*

Herbs with radical leaves crowded often lyrate-pinnatifid, cauline few amplexicaul. Heads red, pink or yellow, long-peduncled, solitary or corymbose homogamous with all florets tubular and herm., elongate 5-toothed. Involucre cylindric, bracts 1-seriate, without any subsidiary bracteoles at the base, striate, sometimes connate. Recept. flat naked. Style-arms subterete. Cypsele subterete or angled and 5-ribbed. Pappus hairs copious soft white.

1. **E. sonchifolia,** *DC.* Sadi-modi, *Beng.*

A nearly glabrous erect, rarely diffuse, herb usually 12–20″ high, with lyrate and usually pinnatifid lower leaves 3–4″ long and few lanceolate or oblong-lanceolate upper cauline leaves with large auricles. Easily recognised by the tubular involucre shortly 8–10-toothed only splitting into its component bracts in fruit and the small rose-coloured florets scarcely longer than the involucre.

Common in cultivated ground! Probably throughout the province. Fl., Fr. chiefly in r.s.

Stems at base and leaves on the nerves beneath sometimes sparsely hairy. Heads ·35″ long in flower, ·5″ long in fruit. Cypsele ·12″ long, nearly uniform in width throughout, with 5 scabrid ribs.

2. **E. flammea,** *Cass.* Syn. Cacalia coccinea, *Bot. Mag.*; Tassel Flower.

A very common garden plant often sowing itself like a weed. It bears heads of scarlet flowers which are much stouter than in the last, and the plant is often but not always hairy.

42. SENECIO, *L.* Ragwort.

Herbs or shrubs, sometimes scandent. Leaves radical or alternate, entire or cut. Heads usually yellow, radiate (rarely ray fls. 0). Involl. bracts 1- or sub-2-seriate, equal, erect with a few very short outer bracteoles, receptacle various. Ray fls. fem. ligulate, disc. fls. herm. tubular, 5-fid. Anther-bases obtuse or auricled or minutely tailed. Style-arms of herm. fl. recurved with truncate and penicillate tips, rarely rounded or with a short narrow point. Cypsele subterete or outer dorsally compressed, 5–10-ribbed, pappus-hairs soft white, smooth scabrid or barbellate.

1. **S. nudicaulis,** *Ham.*

An erect biennial or perennial herb with strong fleshy roots from a short erect stock and glabrous oblong amplexicaul usually lobed and toothed leaves. Heads yellow ·7″ diam. corymbose, ligules about 12, ·25–·3″ long. Involl. bracts ·2–·25″, green, 2-seriate with few bracteoles, inner series oblong with scarious margins, outer acuminate. Cypsele ·06–·07″ ribbed and hispid, apex truncate annular, pappus fine dirty white ·2″, that of ray soon deciduous.

Highest hills of Chota Nagpur. Neterhat plateau! Parasnath! In open grass lands. Fl., Fr. April–June.

Lowest cauline leaves oblong with tapering base, shallowly lobed, upper rarely entire, sinuate or dentate, lobes mucronulate, tip rounded, rather fleshy, cauline with acute lobes or teeth but rounded tip, auricled. Peduncles bracteolate above. Disc fls. tubular-campanulate, numerous, anthers ecaudate, style arms narrow linear with dilated tips, ovary pubescent.

Calendula officinalis, *L.*, is the English Marigold, often seen in gardens in the cold season and called *Genda* by the Indians. The cypseles are curved boat-shaped and muricate, the outer also ventrally crested.

43. ECHINOPS, *L.* Globe-Thistle.

Thistle-like herbs with white tomentum and alternate pinnatifid spinous leaves. Heads compound in globose balls, blue or white, each composed of one flower only, sessile or stipitate on a common receptacle and each surrounded by its proper oblong involucre of many-seriate rigid often spinescent bracts, sometimes all connate into a tube with one long spine on the outer side. Fls. herm. with slender tube and 5 slender lobes, anther-bases sagittate, auricles connate with short entire or fimbriate tails. Style-arms thick and with a thick basal ring. Cypsele elongate, usually villous, pappus of many short free or connate bristles.

1. **E. echinatus,** *Roxb.*

A much-branched spreading rigid annual 1–2 ft. high with numerous cottony-villous 2-chotomous stems. Leaves in outline oblong, pinnatifid with ovate-lanc. sinuate lobes, strongly spinose, minutely scabridly puberulous above, cottony beneath. Balls of heads 1–2″ diam. with a common involucre of short 3-cuspidate spinose bracts. Proper involucres with 6–8 outer oblanceolate bracts of which 1 (or 2) is often produced into a long spine. Florets white,

cypsele ·17″ long, obconic, silkily villous surrounded by the hardening inner connate invol. bracts which are ·3″ long and have ciliate tips.

Behar and Chota Nagpur, *C. B. Clarke.* Hazaribagh! Fl. April-June.

44. CNICUS, *L.* Thistle.

Erect often cottony or villous thistles with alternate often decurrent pinnatifid or toothed and spinescent leaves. Heads usually white or purple, homogamous, all flowers tubular and herm. or rarely dioecious. Invol. bracts many-seriate, outer often foliaceous, usually spinescent. Receptacle densely bristly. Cor.-tube slender 5-fid. Anther-bases with connate auricles and slender tails. Style-arms obtuse. Cypsele glabrous obovoid, top truncate or umbonate, basal areole nearly straight, pappus copious with many-seriate feathery hairs united in a deciduous basal ring.

1. **C. arvensis,** *Hoffm.* Syn. Cirsium arvense, *Scop.*; Carduus arvensis, *Robs.*; Creeping Thistle: Creeping Plume-thistle.

A handsome weed about 2 ft. high with a creeping root and very spinous sessile or very slightly decurrent oblong-lanceolate wavy leaves. Heads numerous, peduncled, ovoid, pale- or lilac-purple, dioecious. Invol. bracts broad-lanceolate adpressed with short spreading spine. Cypsele linear-oblong compressed.

Fields, northern area and cooler parts of Chota Nagpur! Not very common Fl., Fr. c.s.

A common English weed.

Cynara Scolymus, *L.* The Globe Artichoke; Kunjir, *Urdu*; Hathichuk, *Vern.*

This handsome thistle is often cultivated in India, and has heads 5-6″ diam. with blue florets. The base of the inner involucral bracts and part of the receptacle are eaten. The Artichoke is probably only derived by cultivation from *Cynara cardunculus, the Cardoon,* which is native of the Mediterranean region (*De Candolle, Origin of Cultivated Plants*).

45. SAUSSUREA, *DC.*

Herbs often cottony with unarmed leaves. Heads homogamous with purple or bluish herm. fls. with slender tube and narrow 5-fid. limb. Invol.-bracts many-seriate appressed, inner longer narrower. Receptacle densely bristly. Filaments free with sagittate anther-bases and connate auricles with tails usually long entire ciliate or woolly. Style arms-linear. Cypsele glabrous oblong 4–5-ribbed or -angled, top truncate and cupular or crowned with a thickened disc and persistent base of style, basal areole straight, pappus-hairs 1–2-seriate, inner feathery, base thickened and connate into a deciduous ring, outer pappus caducous or 0.

Inflorescence cottony. Achenes ·2″	1. *candicans.*
Inflorescence glabrous. Achenes ·1″	2. *affinis.*

1. **S. candicans,** *Clarke.*

A handsome herb with stems 2–5 ft. high more or less lanuginous, corymbosely branched (or in small specimens scapose and 1-headed). Leaves cottony or white-tomentose beneath, lowest petioled lyrate-pinnatifid, sometimes attaining 18″ by 5″, upper sinuate-pinnatifid

and uppermost narrowly oblong. Heads 1″ diam. long-peduncled in large open panicled corymbs (but see above). Involucral bracts cottony or pubescent, acuminate. Cypsele 5-angled muricate.

Very rare. Hills of Chota Nagpur, Kolhan, *Gamble*! It is chiefly a Himalayan plant. Fl. March–May.

Leaves with a large terminal elliptic lobe and a few lower ones. Heads ·8–·9″ long in fruit with the pappus far exceeding the ·5″ long involucre. Bracts linear-lanceolate, sharply acuminate.

2. **S. affinis,** *Spr.*

An annual less robust herb than *S. candicans*, erect about 2 ft. high (sometimes much more outside our area), with striate puberulous stems and deeply pinnatifid leaves white-cottony beneath, terminal lobe usually large lanceolate or broadly triangular-ovate dentate acute. Heads pink or pale lilac-red ·5–·6″ long, long-pedicelled, in open glabrous panicled corymbs sometimes reduced to a few heads. Outer bracts very short, inner ·3–·4″ with 5–6 distinct dark nerves. Achenes ·1″, pappus ·3″ feathery.

Not common in our area and only on the northern fringe. Extends from Gorakhpur on the west to Rajshaye on the east of it. "Poorneah," *T.T.*! ("Bengal, regio trop.," *J.D.H.* & *T.T.*, but the name may be Poormah?). Fl., Fr. Feb.–April.

Radical leaves long petioled 3–4″, cauline sessile auricled 1·5–2″ rarely 4″ with the segments up to 2·5″ (in Rajshaye) oblong-obovate and coarsely dentate, often the leaves less lyrate than in *S. candicans* with the terminal lobe only 1″ and lateral ·9″, less white beneath than in that species. Longer pedicels of corymb sometimes 4–5·5″. Small Gorakhpur specimens have sometimes only 3 heads.

46. GONIOCAULON, *Cass.*

An erect glabrous annual with acutely 4–8-angled stem. Leaves narrow alt. toothed. Heads narrow, fascicled and corymbose, homogamous with few fls. all herm. with slender tube, limb longer 5-fid to the middle or more. Involucre oblong, base very narrow, bracts many-seriate, pale, very narrow, rigid, acute, outer gradually shorter. Recept. palæaceous. Filaments hairy, anther-bases sagittate, connate with short tails. Style-arms filiform. Cypsele glabrous, oblong, about 20-ribbed, basal areole straight. Pappus of many-seriate very unequal scales.

1. **G. glabrum,** *Cass.* Syn. G. indicum, *Clarke*; Athanasia indica, *Roxb.*

A somewhat strict herb 2–3 ft. high with ribbed and angled hollow stems and narrow sessile serrate leaves 2–4″ long. Heads numerous, purplish-rose, ·5–·7″ long, narrow, florets about 5 only.

High cultivated lands, but rare in our area. Behar, *Kurz*! Fl. Jan.–March.

Stems prominently angled. Leaves oblong, linear-oblong or sometimes obovate, somewhat obovate or spathulate. Heads in terminal corymbs.

47. TRICHOLEPIS, *DC.*

Herbs with entire or toothed leaves or the lower pinnatifid, often with raised dots (crystal-cells?). Heads terminal, solitary, peduncled; florets all herm., with slender tube and limb 5-cleft to the middle, purple red or yellow. Involucral bracts many-seriate, narrow,

often appendaged with long recurved hair-points or slender spines or mucronate, outer shorter. Receptacle densely bristly. Filaments papillose, anther-bases sagittate with connate auricles and slender lacerate tails. Style-arms slender. Cypsele glabrous oblong or obovoid, ribbed with basal areole very oblique or lateral, pappus hairs many-seriate, very unequal, serrulate barbellate or feathery, long and slender or short and paleaceous, or 0.

1. **T. stictophyllum,** *Clarke.*

A herb with a somewhat stout and woody rootstock, branched from the base with branches only 6–10″ long or erect and little branched 2 ft. high (depending on the jungle fires), angular grooved and glabrous. Leaves sessile linear, entire or obscurely toothed, acute or rounded, nerves parallel to the mid-rib. Heads purple long-peduncled terminating the branches, ·8–·9″ long. Invol. bracts appressed, outer glabrous ovate sub-spinose-tipped, inner linear-lanceolate with flexuous hispid acumina. Cypsele many-ribbed ·3″ long, linear-oblong compressed. Pappus copious of slender feathery hairs, ·3″ long, slightly united at the base.

Grass lands on the pats of Chota Nagpur. Neterhat, 3000 ft.! Fl., Fr. April–July.

Leaves 2–5″ long, smooth glabrous. Bristles on receptacle longer than the cypsele.

48. YOLUTARELLA, *Cass.*

Stiff herbs with alternate sometimes spinose leaves. Heads terminating the branches, solitary, purple or blue, heterogamous. Invol.-bracts many-seriate, innermost narrow acute, outer shorter acute, awned or spinescent. Receptacle flat, densely bristly. Outer fls. 1-seriate, neuter, resembling the disc fls. in form, disc fls. herm. with short slender tube and cylindric 5-fid. limb. Fil. glabrous or hairy, anther-bases sagittate, auricles connate shortly tailed. Style filiform, arms free or connate. Cypsele 5–15-ribbed, often striate and pitted between the ribs, basal areole oblique or lateral. Pappus bristles many-seriate, innermost 2–4 dilated and flattened, outermost gradually shorter.

1. **V. divaricata,** *Benth.*

An erect or straggling rigid herb with sub-dichotomously branched channelled slightly scabrid, thinly cottony stems. Leaves 1·5–3″ rarely 5″ pinnatifid (sometimes entire, *F.B.I.*), lobes sometimes lobulate, tipped with short weak spinules. Heads about 1″ long, bottle-shaped, pale purple. Invol. bracts outermost ovate with reflexed spines, inner ·6–·7″ linear-lanc. green with spreading or erect yellow spines, innermost with erect soft spines.

Occasional. Behar, *J.D.H.*! Gya, *Clarke*! Manbhum, *Camp.*! Angul, in the bed of the Mahanadi! Fl., Fr. Jan.–March.

Fls. many. Petals linear. Filaments free minutely papillose, anther tails more or less adnate to filament. Style-arms linear-subulate. Hairs on receptacle ·2″ long. Cypsele compressed 3–4-angled, ·2″, somewhat tapering to the base, striate and punctulate on the ribs. Pappus hairs connate in a ring at the base and deciduous with it.

49. CARTHAMUS, *L.* Safflower.

Herbs with alt. spinescent leaves. Heads normally homogamous, Involucral bracts many-seriate, inner dry, outer with a foliaceous toothed or spinescent appendage (sometimes disappearing in cultivation). Receptacle flat bristly. Florets yellow, white or purplish, herm., rarely a few marginal male or neuter, tube slender, limb dilated 5-cleft, segments long linear. Fil. hairy in the middle, anther bases sagittate, auricles connate with short fimbriate tails. Cypsele glabrous, obovoid, 4 angled or compressed, basal areole oblique or lateral. Pappus 0 or paleaceous.

1. **C. tinctorius,** *L.*; Kusumb, kajirah, *Vern.*

An erect branching herb 1–2 ft. high with broad-lanceolate, spinosely serrate (rarely unarmed) suberect oblong sessile leaves and large terminal heads 1–1·3″ long of orange-red flowers. Outer involucral bracts large foliaceous ovate-oblong 1–1·5″ long constricted above the base, green, usually spinous, inner ovate-oblong or lanceolate acute. Cypsele obovoid 4-angled truncate with 4 bosses at the top.

Cultivated formerly in Patna, Gya and Monghyr, and occasionally in Hazaribagh, but the cultivation appears to be dying out. Soane River, *J.D.H.*! Fl., Fr. Feb.–April.

The very spinose form is known as *Kutela* in Patna, and is probably nearer the original wild plant which may have been *C. oxyacantha* (wild in the Punjab and westwards to Caucasus). The almost spineless form is known as *bhuili* in Patna (*Watts*).

The plant is cultivated not only for the dye derived from the flowers but also the oil derived from the seeds.

Cichorium Intybus, *L.*, is the Chicory and its var., *Endivia*, is the Endive; the latter is cultivated. It is distinguished from the type by its leaves being oblong sinuate instead of runcinate. The flowers are a beautiful blue in heads 1–1·5″ diam. with the corollas all ligulate.

50. CREPIS, *L.*

Herbs with milky or watery juice and radical or alt. often amplexicaul entire toothed or pinnatifid leaves. Heads peduncled, yellow or red, fls. all ligulate and herm. Involucral bracts many-seriate imbricate or outer very much shorter than the linear 1-seriate inner. Cypsele fusiform or oblong rarely short and cylindric, glabrous or scaberulous, 10–20-ribbed, tip narrowed, pappus usually copious, silvery with simple (not feathery) hairs which are rarely brownish, stiff or brittle.

A genus closely allied to *Lactuca* and *Launæa*. From *Lactuca* our species may be distinguished by the cypseles gradually narrowed from the middle to each end, not distinctly beaked, terete or usually only slightly compressed, and from *Launæa* by the many ribs.* They belong to the section *Youngia*, which *Clarke* (*Comp. Ind*) considers should be united to *Lactuca*; some of the cypseles in a head may often be found considerably compressed.

Leaves runcinate or pinnatifid. Heads under ·25″ long . . .	1. *japonica.*
Leaves linear sub-entire. Heads over ·5″ long	2. *acaulis.*

* In *C. acaulis*, however, the finer ribs between the 4–6 strong ones are not always very clear, but seem to be rather the normal surface of the cypsele in which is a groove, and as the cypseles are often compressed *Clarke* placed this species in *Lactuca*. *Sir J. D. Hooker* considered that it belonged to *Crepis* in virtue of its habit. The slight neck distinguishes it from *Launæa*.

1. **C. japonica,** *Benth.*; Syn. C. lyrata, *Clarke.*

An elegant herb, varying much in stature at the time of flowering, 6″ to 2 ft. high with stems simple or branched, glabrous or slightly villous, naked or sparsely foliose. Leaves mostly radical in a rosette, membranous, lyrate runcinate or pinnatifid, from 1·5″ in small specimens to 8″ long in robust ones. Heads very small, ·15–·23″ long, copiously panicled, inner invol. tubular with about 8 linear glabrous bracts, with base of midrib thickened in fruit and united with the similar thickenings of the other bracts, outer bracts few, very short. Flowers 10–20 in a head with very short spreading ligules. Cypseles ·07″ long, rich red-brown when ripe, slightly tapering each end, compressed and often slightly curved, with about 12 fine ribs or ridges, scaberulous above.

Chiefly on damp banks under shade. Champaran! Singbhum! Ranchi, ascending to top of the pats! Parasnath! Manbhum, *Campbell*! Annual. Fl., Fr. March–June and Sept.–Nov., perhaps all the year round.

Stems angular, corymbosely branched above and with scattered slender branches below in luxuriant specimens. Radical leaves with denticulate or mucronate lobes, often puberulous both sides. Petiole slender short. Cauline leaves smaller, and those subtending the upper branches filiform. Pappus white ·1″ long.

2. **C. acaulis,** *Hook. f.* Syn. Lactuca glabra, *DC. & Clarke* (*Comp. Ind.*).

A dwarf herb with flowering stems scarcely more than 2″ high (just after the jungle fires) or erect and attaining 12″. Leaves very narrow, linear, widest in middle or somewhat wider upwards, 3–6″ long, entire or denticulate or sinuate-dentate, glabrous except the papillose margin, scarcely petioled or petiole amplexicaul. Heads cymose on pedicels ·3–1·3″ long. Invol. narrow ·5–·6″ long, bracts about 6–8, linear-oblong with a few outer shorter ones. Florets about 12, ·6–·7″ long, yellow. Cypsele ·2–·25″ long, grey, somewhat attenuate upwards from the middle with a short neck, slightly narrowed at base, with about 5–6 very strong ribs and the intermediate spaces each with a darker narrow groove in their centre.

On the plateaux, usually conspicuous on the bare ground after jungle fires. Chota Nagpur, frequent on the pats and on the hills! Kalahandi! Fl., Fr. March–June.

Rootstock deep fleshy. Stems usually with few leaves. Pedicels with a few bracteoles. Heads ·7–·9″ diam. Bracts green, 3-nerved, with scarious margins. Pappus ·25″ long, white soft silky, microscopically barbellate.

51. LACTUCA, *L.*

Herbs with milky juice. Leaves radical and alternate, cauline often amplexicaul. Heads panicled corymbose racemose or sub-spicate, homogamous, fls. all ligulate. Invol. usually narrow, bracts usually few-seriate, not thickened in fruit, inner slender subequal, outer often very short. Cypsele compressed or flattened, *beaked*, faces ribbed, the middle rib often strongest, beak slender or short, dilated into an entire or toothed pappiferous disc. Pappus copious, hairs very slender, simple, persistent or separately deciduous, sometimes with a minute outer ring.

1. **L. polycephala,** *DC.*

Erect 1 ft. high or with many spreading stems and then somewhat resembling *Crepis acaulis*. Stems glabrous striate often sub-dichotomously branched, sometimes corymbose above with linear amplexicaul and sagittately auricled leaves 1–3″ long, entire or with sharp teeth or dissected. Heads yellow, becoming *globose* in fruit. Involucre bracts about 8, erect in flower, ·25″ long, lanceolate-oblong with scarious margins. Cypsele ·1–·13″ or including the distinct slender beak ·15–·16″ long, prominently closely winged or sharply ridged. Pappus short white with very fine hairs.

Specimens have been obtained from the north and west of the Northern Area, also Purneah, *Kurz*! Fl., Fr. June–Feb.

L. somewhat tapering and widest at the base, sometimes distinctly lanceolate, radical often 4″ long, lateral nerves fine wavy, forming loops parallel to midrib.

2. **L. scariola,** *L.*, var. **sativa,** or L. sativa, *L.*, is the garden lettuce, largely cultivated in India in the c.s.

L. scariola is a native of the Western Himalaya and Tibet.

52. LAUNÆA, *Cass.*

Perennial glabrous herbs with milky, usually yellow, juice. Leaves chiefly radical, sinuate-lobed or pinnatifid rarely only denticulate, often spinulose-toothed. Heads racemose or paniculate, solitary or fascicled, sometimes subsessile on the rhachis, all ligulate and homogamous. Involucre campanulate or cylindric, bracts many-seriate, inner subequal, outer various often small, midrib or keel often thickened in fruit. Anther-bases sagittate with setaceous auricles. Style-arms slender. Cypseles narrow subterete angled or slightly flattened, rarely winged, truncate both ends or rarely emarginate, ribbed; ribs 4–5 very stout and close, sometimes narrowly winged or 2-grooved, truncate each end. Pappus copious, hairs many-seriate, very slender, white, connate at the base into a deciduous ring.

A. Stems stoloniform, rooting at the nodes:—
Heads solitary or clustered at the nodes . . . . 1. *pinnatifida.*
B. Heads not stoloniform:—
Heads sub-racemose, solitary or clustered on the rhachis . . 2. *nudicaulis.*
Heads terminal on the paniculately branched inflorescence . 3. *asplenifolia.*

1. **L. pinnatifida,** *Cass.*

A slender herb with long procumbent stems rooting at all the nodes, where they bear a tuft of entire or toothed leaves and very short flowering stems. Peduncles ·5–1″ long with many bracteoles. Involucre ·5–·6″ long, outer bracts short broadly ovate, inner linear-lanceolate. Cypsele ·2″ subterete with 4–6 thick rounded minutely rugulose ribs. Pappus ·25–·3″, soft, white.

On the sands of the Orissa coast from Konarak (Puri) southwards! Fl. June–Sept.

Root-leaves 1–3″ often pinnatifid-sinuate, others (at nodes) sometimes only ·3–2″ subentire or toothed or larger ones sinuate or runcinate-pinnatifid.

It is one of the sand-binding plants.

2. **L. nudicaulis,** *Les.*

A glabrous herb 6–8″ high with nearly naked sub-erect simple or branched flowering stems from a rosette of radical leaves, or stems

usually numerous spreading and attaining 18″ and then often with leaves at the base of the branches. L. 3–6″ sessile oblanceolate pinnatifid and runcinate or sinuate-lobed or dentate, base much narrowed, margins closely almost spinulosely denticulate. Heads ·3–·5″ long, sparsely sub-spicate and clustered with short bracteate pedicels ·1–3″ long. Cypseles 2-morphic, compressed narrowed above striate and scabrid and corky white with 4–5 broad obtuse ridges scarcely narrowed above. Pappus ·2–·3″ soft white very slender much longer than the minute cypsele.

Behar, *Hope*! Purneah! S.P., bed of the Ganges, *Kurz*! Palamau, *Gamble*! Manbhum, *Campbell*! Singbhum! Fl., Fr. May–Jan.

The denticulations when dry are usually hard and white. Involucre narrow cylindric, outer bracts very short, inner about 8, linear-oblong with white scarious margins, midrib obscure. Florets about 15-20. Purneah specimens collected by *Clarke* have leaves only 2″ long, runcinate, and with close white (when dry) spinulose teeth and sessile clustered heads or the very short pedicels completely clothed with small bracteoles. Invol.-bracts ·4″ long.

3. **L. asplenifolia,** *DC.*

A *Crepis*-like herb with the leaves all radical, 3–5″ long, oblong-oblanceolate pinnatifidly lobed with the lobes usually broadly oblong and patent, acute, obtuse or rounded, entire or denticulate not spinulose-serrulate as in *L. nudicaulis*, glabrous. Scapes several, branched 6–9″ long, naked or with one or two leaves at base, bracts small dry subtending the branches. Heads pedicelled with long or short pedicels. Involucre ·35–·4″ with linear obtuse bracts with scarious margins, few outer shorter and several very short outermost (or bracteoles) at end of pedicel. Cypsele ·08″ with strong ribs which are minutely serrulate and intermediate weaker ribs. Pappus hairs united at their base, ·3″ long, very soft and fine.

Behar, *J.D.H.*! Purneah probably, as it occurs in Maldah! Hazaribagh, *Clarke*! Frequent in the Gangetic Plain. Fl., Fr. Jan.–May.

The Maldah specimens are 1 ft. high with much branched flowering stems and heads ·5″ long. The Behar (Dalalganj) specimens are very dwarf with the scapes only 2″ high, the leaves runcinate with lanceolate lobes.

53. SONCHUS, *L.*

Herbs with milky juice. Leaves radical or alternate, cauline often amplexicaul, entire toothed or pinnatifid, often spinulose toothed. Heads yellow irregularly corymbose umbellate or panicled, fls. all ligulate and herm. Involucre often dilated thickened and conic at the base with many-seriate herbaceous bracts, outer smaller. Receptacle flat naked. Cypsele sub-terete or compressed ribbed, not beaked. Pappus copious, hairs many-seriate, very slender, simple, united at the base into a deciduous ring.

Inflorescence glandular. Cypseles sub-terete with 4–6 strong ribs	1. *arvensis.*
As in last, but inflorescence not glandular	Var. *glaber.*
Inflorescence not glandular. Cypseles flattened sub-alate	2. *asper.*
Inflor. sometimes glandular. Cypseles as in (2), but muricate between the facial ribs	3. *oleraceus.*

1. **S. arvensis,** *L.* Syn. S. orixensis, *Roxb.*; Ban-palang, *Beng.*; Bir barangom, *S.*

A tall crisply-succulent hollow-stemmed herb 3–4 ft. high nearly glabrous or with copious gland-tipped hairs above and always white

flocculent under the young flower heads. L. glaucous beneath lanceolate from an amplexicaul base with rounded auricles, attaining 10–16″ in length and irregularly runcinately pinnatifid and spinulosely denticulate, uppermost linear. Heads (in fresh flower) ·5–·6″ long and ·7–·8 diam., contracted in the middle, umbellate or in umbelliform corymbs, ultimately long-peduncled. Cypseles pale brown sub-terete or somewhat compressed with 4 (–6) strong ribs and 1–2 weaker ones between, ribs all rugulose.

Fl., Fr. Oct.–Feb.

Var. α **typica,** glandular-hairy above. This is rare in our area.

Var. β **glaber,** *Haines.* Gland-hairs absent. Purneah, *Burkill*! Higher hills of Chota Nagpur, Singbhum! Palamau and Ranchi (Neterhat)! Parasnath *Clarke.*

The plant is greedily eaten by horses and cattle.

2. **S. asper,** *Vill.*

A plant of similar habit to the last but the leaves usually broader, sometimes ovate- or obovate-oblong less runcinate and generally copiously spinose-toothed rather than denticulate. Inflorescence never glandular. Heads usually shorter peduncled, the ultimate peduncles rarely more than 2″ while those of *arvensis* are frequently 2–4″ long in fruit. Cypseles very different, being flattened elliptic or obovate with sub-alate margins and three (3–5) strong nerves or fine ribs on the faces.

Occasional as a weed in cultivation (but there are no specimens in the *Cal. Herb.* from our area)! Fl. Dec.–April.

3. **S. oleraceus,** *L.*

Similar to the last and leaves often runcinate-pinnatifid as in *S. arvensis* but the auricles are acuminate, the inflorescence sometimes glandular, heads usually short-peduncled. Cypseles as in *S. asper* but muricate between the ribs.

I have only seen it as a weed in gardens and I doubt whether it is native in the province. Fl. Feb.–May (*Clarke*).

FAM. 79. STYLIDIACEÆ (Candolleaceæ).

Herbs with alternate or clustered entire leaves without stipules. Fls. 1–2 sexual in racemiform cymes, panicles or corymbs, irregular. Calyx superior 2-lipped, corolla seldom regular. Stamens 2, filaments connate with the style into a column, anther-cells ultimately subconfluent. Ovary inferior 2-celled. Stigma at apex of column. Ovules many in each cell on the middle of the septum. Fruit a 1–2-celled, 2-valved capsule, valves sometimes cohering both top and bottom. Seeds many minute, albuminous, embryo minute, next the hilum.

1. STYLIDIUM, *Swartz.*

Corolla with tube split above and 4 radiating lobes, the place of the fifth occupied by a smaller recurved petal or spur at the back of the

sinus. Column elongate, apex at first deflexed, elastically reflexed when irritated.

Leaves clustered. Corolla white or purple . . . . . 2. *Kunthii.*
Leaves scattered. Corolla rosy or purplish . . . . . 1. *tenellum.*

1. **S. Kunthii,** *Wall.*

A delicate little herb 1–4″ rarely attaining 8″ high with rather fleshy broadly oblong spathulate or obovate-orbicular leaves ·3–·5″ clustered about the base or top of the very short stem, and numerous erect long-stalked lax dichotomous cymes of minute irregular white or purple flowers ·12–·15″ diam., sessile at the forks.

Damp ground. Purneah! Sambalpur (*Cal. Herb.*)! Fl., Fr. Oct.–Jan.

Inflorescence with scattered glandular hairs. Buds reflexed. Bracts usually 2 at the forks of the peduncle ·1–·25″ linear-oblong. Calyx upper lip of 3 oblong sepals ·07″ long, lower spoon-shaped, ·12″ long, notched. Corolla lobes ·05–·07″ long, anterior lobes longer than the two lateral, all oblanceolate and emarginate with minute 2-fid ligules at their base. Capsule ·3–·5″ linear, valves dehiscing from the top.

2. **S. tenellum,** *Swartz.*

Stem 4–8″ glabrous simple erect leafy, leaves scattered oblong or oblong-obovate smaller upwards, lower ·5″ narrowed at the base, passing into the linear ·17″ long bracts at the cyme forks. Fls. sessile at the forks, rosy or purplish. Capsule ·5–·75″ linear, valves united at the top and base.

Chota Nagpur, Hazaribagh (var. *minima* with stems only 1–2″ long and 1–4-fid.), *C. B. Clarke*! Manbhum, *Ball* (only ·7–1″ high)! Manbhum, *Campbell* (perhaps from Parasnath)! The last is up to 4·5″ high. Fl., Fr. Sept.–Jan.

FAM. 80. CAMPANULACEÆ.

Herbs or undershrubs, often with milky juice. Leaves alternate, more rarely opposite, simple exstipulate. Inflorescence not cymose, fls. bracteate or axillary, bracteoles 0 (exc. in *Sphenoclea*). Calyx superior or adnate to the ovary, 4–6-partite, usually persistent. Corolla regular or (in Tribe Lobelieæ) irregular, gamopetalous, with valvate lobes. Stamens 4–6 alternating with the lobes, inserted with the corolla on the margin of the epigynous disc (in *Sphenoclea* on the corolla tube), anthers free or syngenesious. Ovary 2–5-celled, ovules many in the inner angles often on swollen placentæ. Style 1 with stigmas as many as the cells. Fruit capsular or more rarely baccate, in *Sphenoclea* circumsciss. Seeds many, small, ellipsoid, albuminous. Embryo erect, radicle next the hilum.

I. Corolla 2-lipped, dorsally split. Anthers connate . . 1. *Lobelia.*
II. Corolla regular. Anthers free or somewhat connate:—
  A. Fls. not in a dense spike, stamens not epipetalous:—
    1. Capsule dehiscing at the top (not involving the hypanthium):—
      Corolla stellately 5-partite. Capsule ·1″ diam. . 2. *Cephalostigma.*
      Corolla campanulate. Capsule over ·2″ diam. . 3. *Wahlenbergia.*
    2. Fruit (including hypanthium) dehiscent at base or sides . . . . . 4. *Campanula.*
  B. Flowers in a dense cylindrical spike. Stamens epipetalous. Capsule circumsciss at top. . . . 5. *Sphenoclea.*

1. LOBELIA, *L.*

Herbs or (non-Indian species) shrubs with alternate toothed or sub-entire leaves and axillary or subracemose flowers. Calyx 5-partite. Corolla longitudinally split above, 2-lipped, upper lip shorter 2-partite, lower 3-lobed. Staminal-tube free or nearly so, 2 lower or all anthers tipped with bristles. Ovary 2-celled with hemispheric placentæ. Stigma shortly bifid. Capsule loculicidally 2-valved above. Seeds very many, minute.

A. Anthers all barbate on the apex:—
  1. Seeds distinctly trigonous:—
    Suberect or ascending, glabrous. Corolla over ·17″ . . 1. *trigona.*
    Very slender erect, thinly hairy. Cor. under ·17″ . . 2. *terminalis.*
    Procumbent, puberulous. Corolla ·25″ . . . . . 3. *affinis.*
  2. Seeds ellipsoid compressed. Erect . . . . . 4. *trialata.*
B. Two anterior anthers only barbellate:—
    Stems 3-alate, spreading. Corolla under ·3″ . . . 5. *uligera.*
    Stems not 3-alate, creeping. Cor. ·3–·5″ . . . . 6. *radicans.*

1. L. trigona, *Roxb.*

A small herb, suberect or with many ascending branches 3–12″ long, glabrous. L. broadly ovate subsessile creno-denticulate ·25–·75″ long. Peduncles from the leaf axils but the latter approximated above, usually two to two and a half times as long as their subtending leaves of which only the uppermost are bractiform. Corolla ·18–·2″ long. Capsule ·2″, base of fruiting hypanthium not tapering acutely into the peduncle. Seeds ellipsoid distinctly 3-gonous.

Rather common in Chota Nagpur in damp places. Ranchi! Singbhum! Manbhum, *Camp.*! Sirguja, *Wood*! Santal Parganas, *Gamble*! Probably in all the Northern Districts. Fl., Fr. Oct.–Jan.

Stems acutely 3-angled, often as much as in *trialata*, from which, in addition to characters given above, it may be distinguished by the ribbed hypanthium and peduncles mostly towards the top of the stem.

2. L. terminalis, *Clarke.*

A very slender erect herb with thinly hairy stems and branches, in our area only 1–3″ high (var. *minuta, Clarke*) but said to attain 10″. Lower leaves ovate dentate under ·5″ (in our specimens; up to ·75″, *F.B.I.*), upper bractiform incised-serrate. Peduncles mostly from the uppermost part of the stem, erect slender some three to five times as long as their subtending leaves or bracts and usually sub-corymbose. Fls. blue, corolla ·08″–·16″. Capsule rounded at base. Seeds distinctly trigonous.

Damp ground among grass on wet pastures, Purneah! Fl., Fr. Oct.–Dec.

3. L. affinis, *Wall.*

A trailing herb with shining slightly angular puberulous branches, broadly ovate petioled leaves ·3–1″ long and solitary axillary long-peduncled blue flowers, the peduncles nearly 1″ long but not usually exceeding the leaves. Hypanthium ·12″ long hairy, rounded at base with sepals ·2–·25″. Corolla as long as sepals, hairy above. Seeds ellipsoid distinctly trigonous.

On moist banks, Purneah! Fl., Fr. Oct.–Jan.
Petioles from one-third to one-half as long as the crenate and denticulate blades.

4. **L. trialata,** *Ham.*

A glabrous suberect or erect branched herb usually 4–8″ but attaining 16″ in height with short-petioled rhomboidly ovate leaves ·25–1·3″ long, the upper narrowly rhomboid and passing into bracts, not approximated as in *trigona*, crenate or denticulate. Peduncles ·25–·5″ shorter or up to twice as long as the subtending leaf or bract. Hypanthium obconic tapering acutely into the peduncle, ·15–·2″ long in fruit, glabrous, not ribbed (or not nearly as distinctly as in *trigona*). Sepals linear. Seeds ellipsoid compressed, not angled.

In similar places and often in association with *trigona*, with which it is sometimes confused though quite distinct. Common in Chota Nagpur in the hills. Singbhum! Ranchi. *Gamble*! Parasnath (Hazaribagh)! Sarguja, *Clarke*! Fl., Fr. Sept.–Dec.

5. **L. zeylanica,** *L.*, var. **aligera,** *Haines** (*sp. v. Journ. As. Soc. Beng.*, xv, 7, p. 316).

A herb with many branches spreading from the root 9–18″ long prominently 3-alate, glabrous. L. ·7–1·3″ long elliptic-oblong obtuse or subacute with broadly sessile base, sometimes with a few short hairs on the nerves beneath, margin rather thickened and crisped-serrate. Peduncles solitary axillary exceeding the leaves. Hypanthium ·22–·25″ turbinate narrowed into the peduncle and with sparse reflexed hairs on the ribs; sepals narrowly lanceolate exceeding the tube and hypanthium. Corolla ·22″ long and broad, posterior petals colourless with a yellow linear appendage, lobes of lip sub-equal rhomboid-lanceolate crisped ·1″ long. Dorsal anthers ciliolate on the edges, 2 anterior barbed at the apex. Capsule ·2–·23″ by ·1″, beaked. Seeds minute brown broadly-ellipsoid scarcely compressed.

Pats of Chota Nagpur near streams. Neterhat 3000 ft.! Fl., Fr. April–June.

6. **L. radicans,** *Thunb.*

A procumbent glabrous herb, stems not angled. Leaves linear or linear- or oblong-lanceolate ·5–1″ narrowed at the base, sessile bifarious, sub-entire or remotely toothed. Peduncles axillary equalling or longer than the leaves. Corolla ·3–·5″ with glabrous or obscurely pubescent tube, green with pink marks and a green gland on each side the central lobe at its base. Two lower filaments hairy. Capsule ·25″ with acute base. Seeds ellipsoid slightly compressed.

Naturalised near the Ranchi lake, *Prain*! *Carter*! Fl. Sept.-Oct.

2. CEPHALOSTIGMA, *A.DC.*

Small, erect branched herbs, sparsely patently hairy. L. alternate subsessile, margin thickened entire, waved or crisped. Flowers small, racemed or panicled on filiform pedicels. Calyx 5-partite. Corolla stellately spreading deeply 5-fid with narrow petals, blue or whitish. Ovary sub-globose 2–3-celled. Style terete with shortly obtusely

* This was described as a new species mainly on account of the anthers. *L. zeylanica*, *L.*, is placed in *The Flora of British India* and other works in the section of Lobelia with anthers all *nearly equally barbate* at the apex. Its close affinity to *L. trialata* was, however, recognised. In *DC. Prodromus L. zeylanica* is included under *L. affinis*, and it is stated that *Linnæus* mixed up different species under this name.

3-lobed stigma. Capsule loculicidally 2–3-valved at the apex, often conical. Seeds very many ellipsoid compressed or 3-gonous.

A. Seeds ellipsoid, not trigonous . . . . . 1. *Schimperi.*
B. Seeds distinctly trigonous :—
Leaves scattered. Calyx patently pilose . . . . . 2. *hirsutum.*
Leaves subverticillate below the panicle. Calyx nearly glabrous . . . . . 3. *Hookeri.*

1. C. Schimperi, *Hochst.*

A little herb usually 6–7″ high but sometimes attaining 12″ mostly with a central stem and copious lateral delicate branches ending in minute flowers. Stems and branches ridged sparsely hairy. Leaves sessile oblong denticulate and somewhat sinuate, upper lanceolate and gradually smaller and narrower. Branches capillary cymose or simple. Fls. pale-blue ·12″ long in flower, ·2″ long in fruit. Calyx patently hairy, the erect linear petals only as long as the sepals. Capsule with a conical beak nearly as long as the sepals. Seeds much longer than broad, not at all trigonous though occasionally slightly angled, shining-brown.

Frequent in the hills of Chota Nagpur in open places. Singbhum! Hazaribagh! Ranchi! Palamau, *Gamble*! Frequent at Neterhat! Fl. Fr., Oct.–Dec.

2. C. hirsutum, *Edgew.*

A little rather weak erect herb 3–7″ high with hairy stem dichotomously branched above. Leaves more membranous than in *C. Schimperi*, ·3–·9″, elliptic-oblong or elliptic, undulate and slightly toothed, narrowed below at base and very shortly petioled, sparsely patently pilose. Pedicels capillary ·12–·5″ long. Calyx patently pilose and sepals linear-lanceolate sparsely hispid-hairy. Corolla pale blue or white starlike ·17–·22″ diam. Capsule with conical tip. Seeds nearly as broad as long, sharply 3-gonous or sub-3-alate.

Chota Nagpur, chiefly on clay soils in the hills. Singbhum! Hazaribagh (Pirtand, Parasnath)! Ranchi, *Gamble*! Fl., Fr. Oct.–Jan.

It is not easily distinguished from *C. Schimperi* except by the seeds. The hairiness of the calyx is rather variable, while the sepals of *Schimperi* are also sometimes slightly hairy. The habit is somewhat different and the leaves usually broader and less sessile.

3. C. Hookeri, *Clarke.*

A very slender erect plant 3–9″ high ending in a paniculately branched naked inflorescence, puberulous or slightly pilose. Leaves tending to be verticillate, elliptic, narrowed both ends and sometimes sub-petioled, often minutely crenate, sparsely pilose. Panicles often nearly naked, the bracts most minute, linear. Calyx ·05–·06″ in flower, ·12″ in fruit, nearly glabrous with glabrous shortly triangular or lanceolate sepals. Corolla ·1″ blue. Capsule with conical tip exceeding the calyx, seeds 3-gonous.

Parasnath, 4000 ft., *Clarke*. Fl. Oct.

Differs from *hirsutum* especially in the glabrous inflorescence and calyx and the more naked panicles. L. sometimes ell.-oblong, often verticillate below the inflorescence which is 2–5″ diam. with very small linear bracts and filiform glabrous pedicels ·3–1″ long.

3. WAHLENBERGIA, *Schrad.*

Herbs with alt. or opp. leaves and loosely panicled flowers. Calyx 5-partite. Corolla campanulate, 5-lobed, often very deeply. Stamens

free from corolla, filaments often dilated at the base, anthers oblong free. Ovary 2–3-celled. Stigma of 3 narrow lobes. Capsule erect 2–3-celled, loculicidally 2–3-valved above. Seeds very many.

1. **W. gracilis,** *DC.*, inc. W. agrestis, *A.DC.*, and W. indica, *A.DC.*

A very variable herb. In our area erect glabrous or very nearly so, 3–8″ with many branches spreading from the root or up to 15″ strict and very slender. Leaves linear to oblong, denticulate, sessile, lower 1–2″, upper reduced to bracts. Branches of panicle usually bifurcate with pale-blue narrowly campanulate fls. ·3″ long or ·25″ diam.

In rice fields or damp ground. Bettiah, *Hieronymus*! Purneah! Chota Nagpur! frequent. Possibly throughout our area. Fl., Fr. May–Jan.

Sepals ·1″ about equalling the hypanthium or slightly longer, linear. Corolla-lobes narrow-ovate, sometimes tipped with a yellow incurved tip, and margins slightly reflexed. Lower part of filament dilated as a rhomboid membrane inclined inwards, filiform above. Capsule ·25–·3″.

4. CAMPANULA, *L.*

Herbs with alternate or radical subrosulate leaves. Flowers blue, purple or white, sub-solitary, panicled spicate or subcapitate, lower often axillary. Calyx deeply 5-lobed, persistent. Corolla campanulate, 5-lobed or 5-fid. Stamens 5 free, filaments dilated at the base. Ovary 3-celled, stigma shortly 3-(5)-lobed. Capsule truncate, dehiscing by small valves at the base or sides. Seeds very many, ellipsoid or compressed.

1. **C. canescens,** *Wall.*

An erect herb with strict hairy stems 8–20″ high, often several from the rootstock. Cauline leaves linear, linear-oblong or lanceolate, 1–2″ long, sessile or contracted into a very short petiole. Flowers lilac or grey-purple, dimorphic (in one form without corolla or stamens), usually subspicate on the branches of narrow panicles, becoming more diffuse with elongate pedicels in fruit.

Alluvial banks of the Soane, Behar, *J.D.H.*! Parasnath, *T.T.*! It occurs on the plateau lands in the Central Provinces and will probably be found in Chota Nagpur on the *pats*. Fl. March–April.

Leaves hairy, entire, serrate or creno-serrate, radical, and lowest cauline leaves elliptic or oblanceolate. Calyx ·2″ or much smaller in the imperfect flower. Corolla campanulate ·25″ or 0 and stamens 0 in the imperfect flower. Capsule ·1″ or (*fide C. B. Clarke*) ·2–·25″.

5. SPHENOCLEA, *Gaertn.*

An annual erect herb with alt. leaves and small flowers, bracteate and 2-bracteolate in cylindrical or somewhat conical capitate spikes. Calyx half-superior, 5-fid. Corolla campanulate, 5-lobed. Stamens on the corolla alternating with the small lobes, filaments short, anthers ovate. Ovary inferior or half-inferior in fruit, 2-celled with 2 large axile placentæ, style very short, stigma simple or obscurely lobed. Capsule membranous below, circumsciss, with numerous small oblong minutely verrucose seeds and terete embryo.

1. **S. zeylanica,** *Gaertn.* Jhil-mirich, *Beng.* (teste *Roxburgh*).

An erect weedy-looking annual with fibrous roots, much-branched stem 1–2 ft. high, fistular, glabrous. Leaves 1–3″ lanceolate, sessile

or shortly petioled, entire. Heads terminal or leaf-opposed ·3–1″ long peduncled. Fls. ·05″ diam., sepals united below on the line of dehiscence of the capsule and falling off with the lid. Minute petals white.

In swamps, but not common. Orissa, Cuttack! Fl., Fr. nearly all the year round.

FAM. 81. PLUMBAGINACEÆ.

Herbs or shrubs with alternate often fleshy simple leaves. Flowers capitate, racemed or panicled on terminal scapes or peduncles with the bracts often scarious and usually sheathing the flower, bracteolæ 2. Calyx inferior tubular, 5–10-ribbed, mouth frequently funnel-shaped scarious. Petals free or gamopetalous with a very short tube, rarely with a linear tube. Stamens 5 opp. the petals and often adnate below to the corolla. Disc 0. Ovary superior, 1-celled, 5-angular above, styles 5, free or connate, stigmas sub-capitate. Ovule 1, pendulous from a basal ascending funicle, anatropous. Fruit capsular membranous or with a hardened apex, rupturing near the base or circumsciss, apex often 5-valved. Seeds cylindric, pendulous, albuminous or not, radicle superior.

Styles distinct. Shrubs with fls. in panicled racemes . . . 1. *Ægialitis.*
Styles united. Shrubs or undershrubs with spicate fls. . . . 2. *Plumbago.*

1. ÆGIALITIS, *R. Br.*

A glabrous small tree or shrub with broad coriaceous leaves and petiole dilated downwards with amplexicaul and winged (adnate stipules?) base. Flowers white or pale yellow in panicled racemes with the pedicel included in the sheathing bract and bracteoles. Calyx tubular strongly ribbed. Petals linear gamopetalous below with the filaments adnate to the persistent tube. Styles distinct, on the angles of the ovary. Ovule large linear. Fruit linear. Embryo free with large hypocotyl and 2 small spreading cotyledons and small white radicle. Albumen 0.

1. **Æ. rotundifolia,** *Roxb.* Bana Ruar, *Or.*

Leaves orbicular or broadly ovate 1·5–3″ long with fine close spreading parallel nervation reticulate between the nerves and a long fleshy petiole 1·5–2″ long with sheathing membranous base. Peduncles from the sheathing base of the petiole and terminal, racemes 1·5–2″ long. Calyx ·5″ with small 2-fid teeth terminating the ribs. Petals with erect linear-oblong lobes ·3″. Filaments long. Capsule ·7″.

Deltaic swamps of the Mahanadi, Cuttack! Fl. Dec.–Jan. Fr. May.

Bark grey, soft, lenticellate. The wood is very abnormal. *Gamble* says that it resembles that of a Monocotyledon, consisting of soft cellular tissue studded with scattered small patches of pore-bearing wood. *Brandis* says that the fruit is 3″ long, but mine appears to be quite ripe with perfect seeds. *Clarke* says (*F.B.I.*) that it is unknown.

2. PLUMBAGO, *L.*

Herbs, undershrubs or shrubs with diffuse or sarmentose branches and entire leaves. Flowers spicate. Calyx tubular covered with stalked

glands, 5-fid. Corolla-tube long slender, lobes 5 spreading round. Stamens free, filaments dilated at base. Ovary narrowed at apex, style slender with 5 branches stigmatose most of their length. Capsule membranous, circumsciss near the base.

Flowers white. L. ovate, suddenly narrowed into petiole . . .	1. *zeylanica.*
Flowers red. L. ell. tapering to the petiole	2. *rosea.*
Flowers blue. A garden plant	3. *capensis.*

1. **P. zeylanica,** *L.*

An undershrub with rambling green branches, ovate or oblong-ovate leaves with the base suddenly narrowed into a short amplexicaul petiole, and terminal panicled spikes of very pretty long-tubed white flowers ·5–·75″ diam., of which the calyx is covered with conspicuous stalked viscid glands.

Usually among rocks. Singbhum! Ranchi! Manbhum, *Camp.*! Parasnath! S.P. (Rajmahal Hills), *Kurz*! Fl. Sept.–Nov. Fr. Nov.–Dec.

Leaves usually about 3–4″ with the short petiole. Fls. 1″ long.

The root is said to excite digestion and promote appetite. It is also used in piles, anasarca, diarrhœa and skin diseases (*Dutt*).

2. **P. rosea,** *L.* It is easily distinguished by the colour of the flowers and is often cultivated, but though wild in the Bengal Duars it is not so in Behar and Orissa. Fl. Feb. and at other times.

3. **P. capensis,** *Thunb.* A well-known beautiful shrub with bright pale blue flowers and sub-verticillate leaves. Native of the Cape of Good Hope.

FAM. 82. PRIMULACEÆ.

Herbs with radical or if cauline alt., opp. or whorled exstipulate leaves. Flowers regular, sometimes dimorphic. Calyx inferior gamosepalous, usually 5-lobed. Corolla hypogynous, rotate, bell- or funnel-shaped usually 5-lobed. Stamens on the corolla-tube, opposite its lobes, with sometimes alternating staminodes. Ovary 1-celled with undivided often capitellate stigma. Ovules many, usually amphitropous on a free central placenta. Capsule dehiscing by valves or circumsciss, few- or many-seeded. Seeds minute, usually angular, often sunk in the placenta. Albumen fleshy or horny. Embryo transverse.

A. Corolla-lobes imbricate. Capsule 5-valved	1. *Androsace.*
B. Corolla-lobes contorted:—	
1. Capsule dehiscing by valves. Corolla 5–6-cleft . . .	2. *Lysimachia.*
2. Capsule circumsciss:—	
Corolla 5-partite, exceeding the calyx	3. *Anagallis.*
Corolla 4–5-lobed, shorter than the calyx	4. *Centunculus.*

1. ANDROSACE, *L.*

Low herbs with rosulate or imbricate leaves and small white or red flowers in 1-several-fld. scapes. Corolla salver-shaped with very short tube or funnel-shaped, mouth annulate or with folds opposite the lobes. Anthers subsessile, included in the tube. Capsule ovoid or globose, 5-valved. Seeds 2, rarely more, angular or subglobose.

1. **A. saxifragæfolia,** *Bunge.*

A delicate little herb with radical suborbicular cordate subentire or serrate leaves ·3–·75″ diam. hairy above. Petiole ·75″. Peduncles

1·5–2·5″ slender with 3–4 fls. ·25″ diam. on slender hairy pedicels ·5–1·25″ long. Calyx enlarged in fruit, with spreading lobes. Corolla white with annulate yellow mouth.

Damp ground and near streams. Singbhum! Purneah! Fl. Jan.–March.

2. LYSIMACHIA, *L.*

Herbs with entire opposite alternate or whorled usually minutely gland-dotted leaves and solitary spicate or racemose usually white or yellow flowers. Corolla rotate or funnel-shaped, 5-6-partite. Stamens inserted on the base of the lobes. Ovary subglobose, style filiform persistent. Capsule 5-valved or bursting irregularly, many-seeded. Seeds 3-gonous or plano-convex.

Fls. white, in elongate racemes . . . . . 1. *obovata*.
Fls. yellow, mostly axillary on very slender peduncles . . . 2. *pedunculariis*.

1. **L. obovata,** *J. D. H.* Syn. L. candida, *Lindl.*, var. obovata.

An erect slender pretty herb with strict leafy stems 12–20″ high terminating in elongate racemes of small funnel-shaped white flowers ·3–·35″ diam. Capsule as long as the persistent calyx.

In watery places, *pats* of Chota Nagpur, elev. 3000 ft. Fl., Fr. May–July.
Glabrous. Radical leaves elliptic or oblanceolate with an attenuate base passing into the petiole, 1·5–2″ with the petiole, cauline alt., erect shorter and smaller upwards, minutely gland-dotted. Racemes 2–8″. Pedicels slender, ·3–·8″ in fruit, shorter or longer than the subulate bracts. Sepals linear acuminate, ·2″, with some yellow glands. Corolla ·3″ long, lobed more than half-way down, lobes oblong rounded ·1″ broad.

2. **L. pedunculariis,** *Wall.*

A small erect annual 4–8″ high, not or sparingly branched, with narrowly winged stems, lanceolate leaves 1–2″ long narrowed into the short petiole and axillary small yellow flowers on axillary capillary peduncles.

Damp places in Bamboo forests, Porahat, Singbhum! Fl., Fr. Dec.–Jan.
Pubescent. Peduncles ·5–1·5″ long. Sep. ·12–·17″, oblong-lanc. acute. Filaments connected at base by a membrane. Capsule ·12″ diam., valves rounded at apex.
Previously only collected in Birma by *Wallich*.

3. ANAGALLIS, *Tournef.* Pimpernel.

Slender herbs with opposite entire dotted leaves and solitary axillary ebracteate flowers. Calyx 5-partite. Corolla rotate 5-partite. Stamens with villous filaments. Capsule globose circumsciss. Seeds many peltate.

1. **A. arvensis,** *L.* Scarlet Pimpernel and Blue Pimpernel.

An erect or procumbent herb with 4-angled branches 5–10″ long and sessile ovate or oblong-ovate or lanceolate leaves ·5–·8″ rarely up to 1″ (in our area). Fls. very pretty blue (in our area, usually scarlet in Europe) ·3–·5″ diam. on slender peduncles which are decurved in fruit.

Usually near cultivation. Champaran! Chota Nagpur, rare, *Wood*! Hazaribagh, *Gamble*! Fl., Fr. Jan.–March.
Branches usually prostrate and ascending. Peduncles 1–2″. Sepals narrow lanceolate, acuminate. Capsule ·25″ diam.
Common in England, often called "the poor man's weather glass" from the flowers closing in dull weather.

4. CENTUNCULUS, *L.*

Small delicate herbs with sub-opp. or alt. entire leaves and minute solitary axillary ebracteate white or pink flowers. Corolla short urceolate. Stamens 4–5 on the throat with filaments flattened at base. Capsule globose circumsciss. Seeds many peltate (*fide F.B.I.*), or with two flat and one convex surface.

1. **C. tenellus,** *Duby.* Syn. Anagallis pumila, *Swartz.*

Erect and strict or with many branches from near the root. Glabrous 1–5″ high, usually crowded with the small leaves and minute flowers. L. ·1–·3″ including the minute petiole, ovate to obovate, acute or obtuse. Sep. narrow subcaudate. Petals lanceolate acuminate from a globose tube. Peduncles equal to or exceeding the leaves, sometimes sub-racemose.

Chota Nagpur, frequent on damp banks! Santal Parg., *Gamble*! Fl., Fr. Oct.–Dec.

FAM. 83. MYRSINACEÆ.

Small trees or shrubs with alternate simple leaves, usually gland-dotted especially round the edges and on the calyx. Stipules 0. Flowers regular 2-sexual or polygamo-dœcious. Calyx inferior or in *Mæsa* more or less superior, 4–6-, usually 5-lobed, persistent, sometimes accrescent. Corolla gamopetalous deeply divided or polypetalous, petals contorted or imbricate. Stamens 3–7 opposite the petals, anthers symetimes connate, very rarely opening by pores. Ovary superior or in *Mæsa* semi-inferior, 1-celled, narrowed into the style, stigma simple rarely shortly lobed. Ovules few or many, inserted on a free central placenta. Fruit usually baccate, in *Ægiceras* cylindric and finally dehiscent. Seeds mostly globose and excavate at the base with pitted or ruminate albumen and transverse embryo.

A. Ovary half-inferior. Flowers racemose. Seeds angled . . . 1. *Mæsa.*
B. Ovary free from the calyx-tube. Fruit 1-seeded:—
1. Fruit baccate sub-globose:—
Cor. nearly or quite polypetalous, very small, white or greenish 2. *Embelia.*
Corolla gamopetalous, small or m.s., pink . . . . . 3. *Ardisia.*
2. Fruit elongate, finally dehiscent. Fil. long . . . . . 4. *Ægiceras.*

1. MÆSA, *Forsk.*

Trees or shrubs with entire or serrate leaves and small 1–2-sexual, 4–5-merous flowers in axillary and terminal racemes, bracteate and 2-bracteolate. Calyx half-inferior or nearly free in flower, adnate in fruit, with small persistent sepals. Corolla gamopetalous with round imbricate sometimes unequal petals. Stamens on the tube with short filaments. Stigma capitate or shortly 3–5-lobed. Ovules many on globose placentæ. Berry globose with numerous subtrapezoid seeds.

1. **M. indica,** *Wall.* Syn. M. montana, *A.DC.* in part; Ramjani, *Beng.*

A shrub 4–8 ft. high with markedly lenticellate branches, ell., ovate or ovate-lanceolate coarsely serrate leaves 3·5–6″ by 1·5–3″ and

small white flowers in simple or compound racemes 1–3″ long. Berry white, ·2″ diam., ultimately sub-coriaceous and smaller.

Valleys and cool sides of hills on the Ranchi and Porahat plateaux! Kochang, *Gamble*! Fl. March–April. Fr. Dec.–Jan.

L. acute to caudate-acuminate, shining above, pale beneath and nearly glabrous with 6–7 sec. n. Fls. ·13″ diam. Calyx-lobes sub-orbicular broadly ovate or sub-orbicular, microscopically ciliate, lineate (in the Kochang specimen). Petals veined sub-orbicular. Fil. very short. Pedicels ·12″.

2. EMBELIA, *Burm.*

Shrubs, mostly climbing, or small trees. Leaves entire or serrate petiole often margined or glandular. Flowers small, polygamous or usually dioecious, white or greenish-yellow sub-fascicled and in axillary or terminal, simple or compound racemes with small bracts but ebracteolate. Calyx 4-5-lobed, persistent. Petals 4–5, free or only slightly connate at base, imbricate in bud. Filaments more or less adnate to petals, anthers ovate-oblong. Stigma capitellate, ovules few. Fruit small 1–(rarely 2-) seeded. Seed globose, base hollowed, albumen pitted subruminate. Embryo curved, transverse.

1. **E. robusta,** *Roxb.* Gointa mata, *K.*; Baberang, *H.*; Bhabri, *S.*; Baibiring, *Or.*; Nununia, *Or.* (teste *Gamble*).

A large shrub or small tree with light grey lenticellate branches, ell. or obovate acuminate or obtuse leaves pale beneath, and small dioecious greenish-white flowers in axillary and extra-axillary racemes ·5–1·5″ long. Fr. red sub-globose ·12–·17″ diam. with a crustaceous epicarp and fleshy endocarp; tipped by the style.

Throughout Chota Nagpur, rather common, especially in open scrub jungles! Santal Parganas! Throughout Orissa to Sambalpur and Puri! Bonai, *Cooper*! Fl. May–July. Fr. Nov.–Jan.

The branches in the type are glabrous, in our specimens the twigs are rusty pubescent or tomentose. A dwarf compact form occurs on Parasnath, but ordinarily the branches are somewhat straggling. Leaves very variable on the same plant 1·2–6″ long, entire or denticulate above, with a very short rusty, sometimes stellate, pubescence especially beneath, narrowed at base into a ·3–·5″ long pubescent petiole; sec. n. 5–9. Pedicels ·12″. Bracts shorter, linear. Calyx pubescent without, deeply lobed, glandular. Corolla ·17″ diam. puberulous. The female flower has short imperfect epipetalous stamens.

The dried berries contain Embelic acid and are used for expelling tape-worms and are also carminative, stomachic and stimulant, used in dyspepsia and skin diseases.

3. ARDISIA, *Swartz.*

Shrubs or small trees with entire or toothed leaves and white or pink flowers in simple or compound umbels or racemes with small usually deciduous bracts. Calyx often somewhat accrescent in fruit. Corolla 5-partite with acute petals twisted to the right in bud. Stamens 5 with very short filaments and ovate-lanceolate acute free anthers. Ovary narrowed upwards, stigma pointed, ovules few. Seed solitary globose, albumen pitted or ruminate.

Shrub or small tree. L. 4–9″. Fls. over ·5″ diam., pink . . .	1. *solenacea.*
Shrub. L. 2–4″. Fls. under ·5″ diam., spotted	2. *depressa.*
Leaves 2–4″. Fls. ·6–·7″ diam.	3. *nov. sp.?*

1. **A. solenacea,** *Roxb.* Syn. A. humilis, *F.B.I.*; Gara Boi (the stream ear-ring), *K.*; Nursing Kara, Batguri, *Or.*

A small tree or large shrub attaining 25 ft. with large bright green rather fleshy leaves clustered towards the ends of the branchlets and mod.-sized rose-coloured waxy flowers with yellow stamens in peduncled axillary often contracted or corymbose racemes. Berry ·3–·5″ diam., depressed-globose, black when ripe.

Along streams, frequent in the forests. Champaran! Purneah! Chota Nagpur! Bonai, *Cooper*! Mayurbhanj! Orissa down to Sambalpur and Kalahandi! probably throughout our area in favourable positions. Fl. April–May. Fr. Oct.–Jan. Evergreen.

Leaves 4–9·5″ obovate-oblong or oblanceolate with numerous obscure secondary nerves narrowed into a petiole ·25″ long. Peduncles 1–3″ stout and raceme often 2–3″. Fls. ·75–1″ diam., both calyx and corolla covered with glands which are black when dry. Sepals orbicular with membranous margins, erect.

2. **A. depressa,** *Clarke.*

A shrub 6–8 ft. with dark green obscurely-nerved wavy, narrow leaves 2–4″ and small pinkish flowers in racemed umbels. Petals spreading waxy white with brown or pink scales.

Near streams. Singbhum, deep valleys in the Karampoda forest, very rare! Bonai, *Cooper*! Mayurbhanj, common in ravines above 3000 ft.! Fl. March–May. Fr. May–June.

Leaves lanceolate or narrowly oblong-lanceolate acuminate 2–4·5″. Twigs rusty tomentose. Leaves entire with numerous very fine sec. nerves, beneath with numerous scattered rusty scales or glands and fewer above. Petiole ·25–·3″ rusty tomentose. Umbels cymose on peduncles ·5–1″ long, axillary or clustered on small shoots and lateral from deciduous scale-leaves. Pedicels ·15–·25″. Sepals spreading lanceolate pubescent. Petals ·12″ long with glands. Fruit globose black ·25″ diam.

3. **A. nov. sp.** *near* A. oblonga, *A.DC.*, and A. solenacea, *Roxb.*

This is an imperfectly known species sent to me by Mr. Haslett without field notes.

Apparently a shrub. L. elliptic-lanceolate 2–3″ long at time of flowering (probably immature), narrowed both ends, punctate, sec. n. fine indistinct, petiole about ·2–·3″. Inflorescence at the base of the new shoots, chiefly from the scars of fallen scales, few axillary, corymbose, peduncles 1–2″ long, pedicels ·6–·8″. Calyx spreading, sepals imbricate ·1–·12″, suborbicular, obtuse or rounded, copiously glandular, margins not membranous. Corolla ·6–·75″ diam., rotate, petals oblong-ovate acute, gland-dotted. Anthers linear-oblong ·25″ less distinctly glandular than in *A. solenacea*. Ovules over 12.

Southern range, Puri, *Haslett*! Fl. April.

It differs from *A. solenacea* in the small leaves and their shape, in the inflorescence at the base of the new shoots, sepals not membranous at margin and other points. From *A. oblonga* in differs in the many-flowered (9- or more-) corymbose racemes, larger flowers and less conspicuous leaf nervation. In *A. oblonga* also the flowers appear before the fall of the mature leaves as they do in *A. solenacea*.

4. ÆGICERAS, *Gaertn.*

A shrub or small tree with entire coriaceous sessile or subsessile leaves and axillary terminal or leaf-opposed ebracteate umbels with slender pedicels. Fls. 2-sexual. Sepals imbricate. Corolla-tube short, petals 5 acute twisted to the right in bud. Stamens on the

tube with linear filaments hairy at the base, anthers cordate-lanceolate dehiscing longitudinally, the cell transversely septate. Ovary oblong narrowed into a filiform style, stigma small. Ovules many immersed in a central globose placenta. Fruit cylindric, curved, acute, coriaceous 1-seeded, tardily dehiscing longitudinally. Seed exalbuminous, germinating within the pericarp, radicle inferior, long, enlarged at the base, cotyledons very short.

1. **Æ. majus,** *Gaertn.* Teluni, *Or.*

An erect very bushy or virgate shrub with obovate or oblong-obovate coriaceous leaves 1·5–3″ long rounded at the tip and narrowed into a ·3–·6″ long stout petiole. Umbels very dense-flowered, subsessile, with oblong pale bracteoles ·15″ long with red glands. Flowers white or somewhat pink with finally reflexed oblong acuminate petals ·2″ long and campanulate tube nearly as long. Stamens exserted with versatile anthers. Ovary linear-oblong pink.

Sea coast and often among littoral rocks. Chandpur, Balasore ! Mahanadi delta. Cuttack ! Chilka lake, Puri ! Fl. Jan.–May.

Glabrous. Sec. n. of leaf 5–6 faint translucent. The leaves sometimes appear to secrete water all over their surface. Pedicels ·3–·4″ long. Sepals broad thick. Young fruit straight, very acuminate, closely embraced at the base by the calyx.

FAM. 84. SAPOTACEÆ.

Trees or shrubs usually with milky juice, the young parts usually rusty-tomentose. Leaves alternate coriaceous entire petioled exstipulate, or stipules very caducous. Flowers 2-sexual axillary (*Sarcosperma*, not so far found in our area, has subopposite leaves and panicled flowers), often from leafless axils, bracts and bracteoles 0 or minute. Calyx inferior with 4–8 imbricate lobes or lobes 2-seriate and outer valvate, persistent. Corolla-tube shorter than calyx with the petals as many or 2–4-times as many as its lobes. Stamens on the corolla tube epipetalous 1–3-times as many, or some reduced to staminodes, 1–3-seriate, fil. short, anthers oblong-lanceolate, connective often produced. Ovary sessile 2–8-celled with linear style, stigma a point. Ovule solitary in each cell, axile. Fruit baccate 1–8-seeded. Seeds ellipsoid or compressed, hilum long, testa usually crustaceous. Embryo straight with large fleshy cotyledons or albuminous with flat cotyledons, radicle inferior.

Sepals and petals each 5, imbricate . . . . . 1. *Sideroxylon.*
Sepals 4, 2-seriate, petals 6-12 . . . . . 2. *Bassia.*
Sepals 6–8, 2-seriate, petals 18–24, 2-seriate . . . . . 3. *Mimusops.*
Sepals 6, 2-seriate. Petals 6, imbricate . . . . . 4. *Achras.*

1. SIDEROXYLON, *L.*

Trees with milky juice and small flowers in axillary fascicles, pedicels pubescent villous or tomentose. Calyx lobes 5, much imbricated. Corolla tube campanulate, petals 5 imbricate. Stamens attached to base of corolla, 5 perfect, 5 reduced to staminodes, sometimes petaloid. Ovary villous 5-celled. Berry 5-fewer-seeded. Seed albuminous, usually oblong, compressed, testa hard.

1. **S. tomentosum,** *Roxb.* Panial, *Th.*; Kanta Bobhula, *Or.*

A small or m.s. usually thorny tree with tomentose or densely brown-hairy twigs, and obovate elliptic-obovate or oblanceolate leaves 2–5″ long clustered towards the ends of the twigs with 9–12 straight strong spreading sec. n., pubescent or tomentose beneath especially when young, slightly rusty or glabrescent above. Flowers white rather small with corolla ·3–·35″ long, solitary or fascicled mostly from old leaf scars. Fruit yellowish subglobose or broadly ovoid 1–1·25″ long seated on the 5-fid calyx. Seeds usually only 1 developed, deep-brown.

Bettiah forests! Singbhum, valleys in the Latua and Saranda forests, near streams! Santal Parganas! Frequent in the Southern tract near streams. Puri! Bonai, *Cooper*! Puri! Angul! to Sambalpur! Fl. April–June. Fruit ripens the following March–April. Evergreen.

Bark grey or light brown, blaze bright red exuding drops of milky juice. Leaves rarely 6″ long by 2·5″ wide, obtuse or suddenly acute, base narrowed into the ·25–·3″ long petiole. Hairs branched. Sec. n. not always much stronger than the intermediate, reticulate some distance from the margin. Two outer sepals ovate-oblong pubescent or tomentose, inner narrower. Petals twice as long as tube. Stamens opp. the petals alternating with a corona of petaloid staminodes with filiform tips. Ovary tomentose. Fruit with very bitter flesh.

Wood light brown, moderately hard. Wt. 56 lbs., *Gamble*. Used for beams and carpenters' planes, *Beddome*.

2. BASSIA, *L.* Mohwa.

Trees with coriaceous leaves clustered at the ends of the branchlets with deciduous caducous stipules. Flowers axillary or from the axils of fallen leaves. Sepals usually 4 with the two outer valvate enclosing the inner pair, very rarely 5 imbricate. Corolla campanulate or ovoid-urceolate with 6–12, usually 8 or 10 small lobes 2-seriate, contorted in bud. Stamens 12–40, anthers lanceolate, connective often mucronate or tailed. Ovary villous, cells 4–12, usually 6 or 8. Berry 1–3- rarely 4–5-seeded. Cotyledons fleshy.

The germination is hypogeal.

L. with 10–12 sec. n.	Corolla fleshy. St. 22–26	1. *latifolia.*
L. with 15–20 sec. n.	Cor. not fleshy. Stamens 30–40	2. *butyracea.*

1. **B. latifolia,** *Roxb.* Mahua, *H.*; Madkom, Mandukam, *K.*; Mahul, *Beng., Or.*; Madgi, *Uran.* The fruit or seed is known as Kochra, *Beng.*; Kuindi, *K., S.*; the oil Kuindi sunum or dola, *K., S.*

A large or m.s. tree with dense rounded rather low crown, pubescent or tomentose twigs, large elliptic or oblong-elliptic rigid leaves 5–8″ by 2·5–3·5″ with petioles 1–1·5″ long, and numerous ovoid very fleshy cream-coloured flowers on long rusty-tomentose pedicels clustered at the ends of the usually leafless branches, from the leaf scars. Berry ovoid 1–2″ long.

Common throughout the Central tract, but in the forests chiefly confined to the hills. North of the Gangetic plain it is scarce but is found occasionally! *Hamilton* recorded it as only common in the south-west corner of Purneah. Common in the Southern tract, but less so in the Puri and Angul districts. Fl. Feb.–April when more or less leafless. Fr. June–July. The leaves at the top of the tree usually fall first; the new leaves appear about May.

Bark nearly smooth, brown, blaze thin brown, then thick and red or dark red, with visible latex tubes which exude drops of latex. Corolla-tube ovoid ·5″ long, petals elliptic or narrowly elliptic ·22–·3″ long, erect in flower, 7–14 according to

some authorities, in my specimens 8 in two series with the outer series twisted, the inner imbricate. Stamens sub-sessile, anthers dorsally hairy, aristate, 3-seriate. Seeds ellipsoid, 1 double convex, or 2–4 more or less flattened on one or two sides, pale-brown, 1·3-1·5″ long with a long hilum, testa easily cut with milky juice.

The flowers form the well-known and valuable article of food, the part eaten being the fleshy corollas, which after being sun-dried have the colour of raisins. Alone they are said to be indigestible and are usually cooked with rice or rice-water. When raw they are a favourite food of wild animals. A spirit (daru, *H.*, arki, *K.*) is also distilled from them. It is said to be a powerful stimulant as well as an astringent tonic and appetiser, and to be largely used on the continent of Europe for the manufacture of brandy. The unripe fruit is cooked as a vegetable. The oil from the seeds is used to adulterate ghee, for cooking, for lighting and for the manufacture of soap and candles. To obtain it the kernels are split and sun-dried, pounded into coarse flour in the "dhenki," then put into an air-tight basket, steamed, wrapped up tight in Sabai grass and put into the oil-press. *Nadkarni* says that the bark is a remedy for rheumatic affections and cures itch.

The wood is good and largely used for oil mills but living trees are never felled by the Kols. *Gamble* says that it is hard and durable and he gives the wt. as about 62 lbs.

As no care is taken by the natives to propagate the tree there is probably a gradual decrease in their number, and most of the trees being outside the Reserved Forests, Sir E. Gait has recently caused plantations to be made of it on waste grounds in Singbhum. The seed germinates readily but the tree is exceedingly slow-growing. The seed is sown in July or as soon as ripe as in damp weather the radicle will start growth without sowing. The seeds germinate in about 10 days. The plumule is stout, somewhat rusty pilose. Those sown by me at Chaibassa attained an average of 22 ft. high and 13·8″ girth after 16 yrs. This is exceptional as *Campbell* in Manbhum records trees of 28 yrs. old only 15 ft. high, *Crawfurd*, at Purulia, trees 15 yrs. old and 10 ft. high. *Mr. Grant* in Bhagalpur planted about 12 bighas with nursery plants 6″ high and after 3 yrs. with constant cultivation and watering the plants were 2–3 ft. high and less. The tree moreover needs much protection as cattle and goats browse it down, which is the reason of natural seedlings being seldom found in the fields. The Chaibassa soil is a decomposed gneiss. The tree is light-demanding but likes a little shade when young.

2. **B. butyracea,** *Roxb.* Chiuli, *Th.*; Gophal, *Beng.*

A large tree with very large obovate leaves 9–12″ long clustered towards the ends of the branches, villous beneath or glabrous when mature, shining above with usually 16–22 strong sec. n. arching or forked within the margin. Petiole ·7–1″ Flowers white on crowded rusty pedicels ·7–1″ long just below the new leaf-bud. Sepals ·3–·5″ ovate. Corolla ·7″ with 8–10 spreading oblong petals free nearly to the base. Berry ellipsoid green shining with milky juice, 1·75″ by 1″ or smaller, seated on the 5 persistent closely imbricate suborbicular pubescent or tomentose calyx-lobes which have thickened bases. Seeds usually 1–2.

Rare in our area. Ravines in the Sameshwar hills, N. Champaran! It also occurs in the Morung on the Nepal side of the Purneah boundary. Fl. Oct.–Dec. Fr. April-July. Nearly evergreen, new leaves about the time of flowering.

The tree attains 10 ft. girth in the hills further east, but has not been observed large in our area. Bark thick dark grey. Stipules lanceolate acuminate ·15–·2″ caducous.

The fruit is eaten and also yields a vegetable butter and is used for soap and candles, but is too scarce to be of economic value in Behar and Orissa.

3. MIMUSOPS, *L.*

Trees with coriaceous leaves with many fine spreading secondary nerves. Flowers often fascicled. Sepals 6 or 8, 2-seriate, outer valvate, inner imbricate. Corolla-tube very short, petals 6 or 8 with

double ligules on their backs or (according to another view) 18-24, 2-seriate. Stamens 6-16 inserted with the petals, usually 6 or 8 and as many, often toothed or lobed, staminodes; connective excurrent. Ovary hirsute 6-8-celled. Fruit a globose or ovoid berry. Seeds 1–6, compressed, ellipsoid with fleshy albumen and flat cotyledons.

In *M. hexandra* the petal is smaller than its 2-fid ligule and appears like a ventral ligule on a 2-fid petal, but in *M. fragrans* and others the dorsal series are very slender or fimbriate. In *M. Elengi* the grouping into threes is less apparent, and *Clarke, Prain* and others describe the lobes of the corolla in the genus as 18-24, 2-3-*seriate*. The dorsal lobes or appendages always seem to be, however, in one series.

L. elliptic, acuminate. Flowers 8-merous (few also sometimes 6-merous) . . . . . 1. *Elengi*.
L. obovate, rounded. Flowers 6-merous . . . . . 2. *hexandra*.

1. **M. Elengi,** *L.* Bakul, *Beng.*; Baula, *Or.*; Molsuri, *H.*

A large or often a small tree with shining glabrous elliptic usually acuminate leaves 2·5–4″ long and fascicled white pretty star-like flowers about 1″ diam. on pubescent pedicels about as long as the petioles. Sepals usually 4+4, but rarely 3+3 on the same tree. Corolla lobes 24 (8 petals with their 2-fid ligules) all lanceolate and sub-similar. Stamens 8 and an inner series of petaloid rather membranous, villous, usually toothed, staminodes. Fruit rather variable, usually narrowly ovoid 1″ long, orange-coloured, 1-seeded.

Very frequently planted in gardens and near temples in all districts! Fl. April-May. Fr. r.s. Evergreen.

The flowers are fragrant and are held sacred. They yield a volatile oil used as a stimulant medicine and perfume. A fixed oil is obtained from the seeds. The unripe fruit is very astringent and recommended for loose teeth. Other medicinal uses are given by *Nadkarni* and *Dutt*.

2. **M. hexandra,** *Roxb.* Khirni, *H.*; Khirokuli, *Or.*

A small tree (in our area, but sometimes very large) with glabrous oblanceolate-oblong, elliptic or elliptic-obovate leaves rounded and always some emarginate at the tip, usually 3–4″ long with obscure sec. nerves. Petiole ·3–·5″. Flowers ·25″ small, white, on ·25–·3″ long pedicels in fascicles of 2–6 and from the axils of fallen leaves. Sepals 3+3. Petals 6 narrower than their 2-fid ligules. Berry oblong ellipsoid ·5″ long.

Purneah, perhaps only feral! Orissa, wild! Often cultivated. Fl. Nov.-Jan. Fr. April-June. Evergreen.

Bark rough grey, blaze crimson, exuding (like the last) drops of latex. Leaves clustered towards the ends of the branches.

Whether the large tree is different from the small one or shrub I do not know, but there are two distinct varieties in our area.

Var. **typica.** Leaves 3–4″. Outer sepals elliptic or oblong. Staminodes narrow, often 2-fid. Anthers twice as long as filament.

Var. **orixensis.** Leaves 3·5–6″. Outer sepals broadly ovate, only ·17″. Petals appearing as mere ligules in the sinuses of the outer linear lobes (the true ligules). Filaments slender twice as long as the short broad anther. Staminodes very short sub-quadrate fimbriate.

The fruit is eaten, but it is very poor.

4. ACHRAS, *L.*

Tree with coriaceous shining leaves clustered at the ends of the branches. Flowers rather large, solitary axillary. Sepals 3+3,

outer sub-valvate. Corolla sub-globose with 6 (rarely 5) imbricate almost contorted petals half as long as the tube or longer. Stamens one opposite each petal inserted at its base alternating with petaloid staminodes. Ovary 10–12-celled. Style with small lobed stigma. Berry globose or ovoid, somewhat umbonate, 4–12-seeded. Testa hard, albumen fleshy, cotyledons large flat.

1. **A. sapota,** *L.* Sapota, Sapodilla-plum.

A large handsome tree with rough dark grey bark and dense crown. Leaves oblong-lanceolate or elliptic-oblong, 3–5″, obtuse or subacute, shining both sides with numerous very fine inconspicuous sec. n. and petiole ·5–·75″ long. Flowers long-pedicelled. Fruit globose, 1·5–2″ diam. usually with 5 large black shining seeds, pink flesh and brownish epicarp.

Cultivated, more especially in Orissa. Fl. April. Fr. Feb.-March. New leaves with the flower-buds March–April. Evergreen.

The fruit is very palatable. It is a native of South America, where the astringent bark and bitter seeds are used medicinally.

FAM. 85. EBENACEÆ.

Trees or shrubs with alternate, rarely subopposite or opposite exstipulate entire leaves and regular, usually dicœcious, usually bracteate and 3–7-merous flowers axillary, solitary clustered or shortly cymose with the pedicels articulate under the flower. Calyx inferior gamosepalous, often accrescent in fruit. Corolla gamopetalous, regular, with petals overlapping to the right, very rarely valvate. Stamens inserted at the base of the corolla, as many or 2–3 times as many as the petals, free or filaments more or less grouped, anthers mostly narrow-lanceolate, with lateral dehiscence, rarely with apical pores; in the female flower reduced to staminodes rarely 0. Ovary sessile 2–16 celled with 1–2 anatropous pendulous ovules in each cell, styles 2–8 free or connate at base with small or often flabellate stigmas. Fruit baccate, coriaceous or fleshy, with as many cells and seeds as in the ovary or fewer–1 by abortion. Seeds compressed, testa thin, albumen copious often ruminate. Embryo axile, straight or more or less curved with flat cotyledons and superior radicle.

Flowers mostly 3-merous. Ovary 3- or 6-celled	1. *Maba.*
Flowers mostly 4–5-merous. Ovary 4–5- or 8–10-celled . . .	2. *Diospyros.*

1. MABA, *Forst.*

Trees or shrubs with alternate entire leaves and dicœcious axillary 3-merous flowers, solitary short-pedicelled or in small dense cymes. Calyx 3 (–5)-partite or -lobed often cupular and enlarged in fruit. Corolla tubular lobes 3 (–5) twisted to the right. M. fl. stamens 3–22, filaments paired or otherwise connate, ovary rudimentary. Fem. fl., staminodes 0–12, ovary 3-celled or 6-celled or 3-celled with imperfect septa between the ovules, ovules 6 altogether. Fruit 1–6-celled and -seeded. Albumen uniform.

1. **M. buxifolia,** *Pers.* Goakuli, Guakuli, Gaurkasa, *Or.*; Angaru, *Beng.*

A twiggy much branched shrub or small tree with box-like leaves ·4–1″ long, small white flowers ·18″ long, the males usually in very short cymes, the females 1–3 together. Berries ·3″ long, ellipsoid-oblong, hairy above especially at base of style, sub-coriaceous succulent, 1-seeded.

Cuttack and Puri, usually in scrub jungles near the coast! Fl. March-April. Fr. June-July. Evergreen.

Young shoots pubescent. Leaves sometimes 1·3″ long, round, oblong or obovate, coriaceous with the few sec. n. scarcely stronger than the fine reticulation. Petiole hardly any. Male fl. smaller than female, about ·14–·15″ long only; calyx cupular 3-4-lobed, minutely hairy, about half as long as the corolla; corolla tubular, strigosely hairy on the outside; stamens 3 (6-12, *F.B.I.*, perhaps variable but 3-merous). Fem. fl. with broader obtusely-lobed calyx, and corolla ·17″ long with 3 strigose lines or patches, lobes sub-orbicular, staminodes 0, ovary 3-celled, style rather long with 3 minute lobes at apex.

2. DIOSPYROS, *L.*

Trees, rarely shrubs. Flowers green, white or yellowish, males mostly in 3-more-flowered cymes, females usually solitary. Calyx 3–5-lobed but mostly 4–5-lobed, often nearly to the base, often hardened in fruit. Corolla tubular, salver-shaped or campanulate with usually as many lobes as calyx, twisted to the right. M. fl. with 8–64 stamens, often in pairs, pistillode present. F. fl. with 0–16 staminodes. Ovary 4–16- usually 8-, very rarely 6- but never 3-celled. Ovule 1 in each cell. Styles short with often spreading or lobed stigmas. Fruit usually showing marks of the suppressed cells, seeds oblong.

The nervation is usually characteristic with alternate sec. n. and numerous often nearly as strong intermediate nerves, all forked and usually minutely reticulate. Petioles always short.

KEY.

I. Indigenous species. Leaves mostly under 9″ long (except on coppice shoots and sometimes *Embryopteris*).

MALE PLANTS.

A. Flowers in peduncled cymes:—
  1. Stamens 12-16:—
    a. Flower-buds with short calyx and conical twisted corolla:—
      i. Calyx flat or saucer-shaped:—
        Bark dark, rugose. L. narrow 1–4″ pubescent — 1. *cordifolia.*
        Bark light, smooth. L. ell. or ell.-ovate 2-6″. — 2. *montana.*
      ii. Calyx tubular, sometimes half as long as corolla:—
        Bark dark. L. oblong-acuminate 4–7″ . . — 6. *ebenum.*
    b. Fl. buds ellipsoid or ovoid-oblong, calyx half as long as corolla or longer, tomentose . . . — 8. *melanoxylon.*
    c. Buds subglobose. St. 13–22. Corolla urceolate . — 5. *sylvatica.*
  2. Stamens 18–22 or more:—
    Fl. buds globose. Cor. urceolate ·1–·15″ . . . — 5. *sylvatica.*
    Fl. buds ovoid-oblong. Corolla ·3″ St. 20–64 . . — 3. *embryopteris.*
B. Flowers in sessile or subsessile cymes or clusters. Stamens 13–20:—
  L. 3–4·5″ long. Corolla glabrous . . . . . — 4. *ovalifolia.*
  L. 1–3·5″. Corolla with hirsute broad lines . . . — 7. *chloroxylon.*

FEMALE PLANTS.

A. Flowers large, over ·5″ diameter:—
  1. Corolla broadly campanulate or urceolate with spreading lobes, usually broader than long:—

a. Evergreen. Fls. white 1″ diam. 1-5 together. Fr. over 1″ diam. with a rusty scurf . . . . 3. *embryopteris.*
b. Deciduous. Flowers with the new leaves, ·45-·55″ diam. :—
i. Ovary glabrous. Flowers solitary :—
L. pubescent 1–4″. Peduncle slender ·25-·3″. Frt. globose yellow 1-1·5″ diam., sepals ovate-lanceolate . . . . . 1. *cordifolia.*
L. often glabrous. Peduncles mostly under ·25″. Frt. globose to conical greenish-yellow, sepals rounded . . . . 2. *montana.*
ii. Ovary hairy. Fls. sub-sessile, reflexed sepals ferruginous-tomentose in fruit . . . 4. *ovalifolia.*
B. Flowers m.s. or small, under ·5″ diam. :—
1. Cor.-tube urceolate or broadly campanulate :—
L. 4–8″. Fls. over ·25″ diam. Calyx puberulous . 5. *sylvatica.*
L. 1-3·5″. Fls. ·18″ diam., calyx densely hairy. Frt. ·3″ diam. . . . . 7. *chloroxylon.*
2. Corolla tubular, longer than broad :—
Calyx with cupular tube with a raised rim girting the ovary and fruit. Leaves narrow-oblong acuminate 6. *ebenum*, var.
Calyx not cupular. Inflorescence densely hairy. L. elliptic or ell.-ovate . . . . . 8. *melanoxylon.*
II. Cultivated or imperfectly known species. L. 7–10″ long exc. in 11 :—
Wild. L. oblong or ell.-oblong, glabrous, acuminate . . 9. *variegata?*
Cultivated. Leaves of same shape, silvery-silky . . . 10. *discolor.*
Cultivated. L. ovate about 4·5″ by 2″. Frt. 1–3″ diam. . 11. *Kaki.*

1. **D. cordifolia,** *Roxb.* Syn. D. montana, *F.B.I. in part*; Ban-gab, *Beng.*

A small tree with dark bark, often thorny with branched thorns, pubescent twigs and small oblong pubescent leaves 1–3″ long with cordate or very rounded base. Male cymes mostly 3-flowered, fls. white ·25″ long, campanulate with short spreading lobes. Fem. fl. solitary on slender peduncles ·25-·3″ long. Berry globose orange-yellow 1–1·5″ diam., albumen somewhat ruminate. Fruiting sepals triangular-ovate usually acuminate, calyx thickened at base but not at all cupular.

Doubtfully wild in the Northern and Central areas but planted at Purulia, Manbhum, Monghyr! Undoubtedly wild in the Southern area: Balasore! Puri forests, frequent! Fl. April. Fr. ripens following March–April. Nearly or quite evergreen in the damper localities, bearing its flowers on the new shoots.

Bark on young trees nearly smooth but dark, on old trees rugose. Blaze brown, then yellow. Thorns sometimes bearing leaves. Leaves rarely 3·5 by 1·35″, lanceolate or mostly oblong, sometimes oblong-ovate, very small ones at base of twigs often obtuse, others acute or acuminate, sec. n. usually 1–3 near base and 4–5 above, weak. Petiole ·13-·25″. Male cymes rarely more than 3-fld., buds conical with saucer-shaped pubescent calyx obtusely lobed, fls. ·2″ diam. St. about 8 prs. Fem. fl. white, turning brown below and whitish above, calyx ·6″ diam., sepals twice as long as the tube, enlarged to ·5″ in fruit, not hardened, corolla-tube urceolate-campanulate ·2″ long, limb ·45-·5″ diam., staminodes 9–13 usually 8. Berry not at all apiculate, flesh very bitter.

2. **D. montana,** *Roxb.*, incl. D. Kanjilali, *Duthie*; Sakamhara, *M.*; Saratiril, *K.*; Gada terel, *S.*; Patwan, *Kharw.*; Paten, *Uran*; Bis Tendu, *H.*; Halda, *Or.*; Hinjalman, Poten, *Gond.*

A small or m.s. tree with smooth reddish or greenish pale bark, glabrous shoots and twigs or sometimes puberulous, and ovate-oblong,

elliptic or ell.-ovate very finely reticulate glabrescent leaves 2–6″ long with obtuse, rounded or subacute base. M. fl. green in 3–7-more fld. cymes. Buds conical with the deeply lobed calyx only one-third or one-fourth as long as the twisted corolla, corolla after expansion tubular-campanulate with tube ·15″ and 4 rounded spreading lobes ·08–1″ long. Fem. fls. ·5–·75″ diam. on very short peduncles rarely ·25″ long (very exceptionally ·3″), sep. 4 broadly- or ovate-oblong with rounded apex coriaceous in fruit. Fr. 1″ globose to somewhat oblong or with short conical tip.

Usually near nalas, nowhere very common but widely distributed. North Champaran forests! Purneah! Santal P.! Chota Nagpur, frequent! Puri! Common in the Mals! Mayurbhanj! Bonai, *Cooper*! Athmallik! Angul! Sambalpur, frequent! Kalahandi! Fl. April–June. Fr. Dec.–Feb. Deciduous, the flowers appearing with the very young leaves.

Bark peeling in very thin flakes, blaze green, then yellowish or flesh-coloured, rapidly darkening on exposure. Trunk and branches sometimes with stout conical thorns, at other times unarmed. Leaves attain 6·5″ by 3·5″ when mature, glabrous or pubescent, sometimes slightly cordate. The very fine darker nervules neither raised nor depressed well mark this species when once seen. Petl. ·15–·3″. Cymes with slender peduncles and pedicels and subulate bracts. St. 12–16, paired. Fem. fl. green or yellow, tube urceolate, limb spreading, ·5–·75″ diam., staminodes 2, 4 or 8. Frt. greenish yellow, finally black, ·7–1″ diam.

There are two forms which pass into one another:

α. Leaves always quite glabrous, more membranous than in the next.

β. Kanjilali (*Duthie sp.* in part). Leaves pubescent or glabrescent, usually more coriaceous when old and more grey in appearance. The pubescence is often very minute.

In both the apex may be obtuse or suddenly acute, more rarely shortly acuminate, sec. n. 7–11 from a very broad midrib, raised beneath when old, the lowest 2–3 usually very close to the base, very finely reticulate between.

Used for the wall-plates, etc., of native houses.

3. **D. embryopteris,** *Pers.* Kendu, Gara tiril, *K.*; Maka-kenda, *S.*; Maka-tendu, Kala-tendu, Gab, *H.*; Thusra-kendu, *Or.*

A handsome tree with low spreading branches almost to the ground, coriaceous oblong or narrowly oblong glabrous shining leaves 5–9″ long or more, with rounded or obtuse base. Flowers white fragrant. Males in umbellate cymes, buds ovoid-oblong with 4 small silky patches. Fem. fls. 1″ diam., solitary. Fruit 2·5–3″ diam., globose, covered with a deciduous red scurf.

Frequent along streams in the Central and Southern areas, especially in deep rocky ravines! Very common in the Mals of Puri! Fl. April–May. Fr. ripens the following April. Evergreen; the new leaves, which are bright crimson, appear about April.

Bark black, smooth. Leaf-buds lanceolate silky, L. acute or obtuse, sec. n. many, fine, scarcely raised, inclined very obliquely forward, very reticulate between. Petiole ·5–·6″. Male peduncles ·3–·5″ pubescent, often only 4-fld., calyx urceolate silky, corolla nearly ·5″, campanulate or urceolate with short sub-orbicular lobes; st. 20–35 or more, paired, pubescent. Fem. peduncles stout ·5″, sepals ·5″, broadly ovate or sub-orbicular, 1″ in fruit and foliaceous with cordate base, petals 4–5, ·5″ diam. Seeds usually about 8, large in pulp.

The pulp of the fruit is largely eaten by monkeys and said to be sometimes eaten by human beings, but to produce great thirst; I find that it burns the throat. The pulp is very viscid and is used for caulking (gab) boats. It is full of tannin and *Gamble* says is used for making fishing nets more durable. Both rind and bark have astringent properties, and are used medicinally in diarrhœa and for

hæmorrhage of internal organs and as a styptic for wounds. The oil from the seeds is also used in dysentery.

4. **D. ovalifolia,** *Wight.*

A small tree with narrowly elliptic or oblong leaves 3–4·5″ long with rounded or slightly retuse tips, petiole ·15–·25″, sec. n. about 8 not strong, soon reticulate and with close reticulations between. Fls. sessile clustered axillary and from leaf scars. Male 3–12 together, ·17″ long campanulate, calyx ·1″, tomentosely hairy with spreading lobes as long as the tube, corolla lobes short ovate, stamens 13–20 glabrous. Fem. fl. 1-2 (2–6, *F.B.I.*) together, ·25″ diam. with broadly ovate petals and 0–7 staminodes, ovary hairy 4–6-celled. Fruit ·7″ globose subsessile glabrate with the reflexed lobes of the calyx ·2″ long and broad, permanently tomentosely hairy both sides. Albumen equable.

Puri Division, very rare (Burkul) *Gamble*! Flowers with the new leaves May–June.

5. **D. sylvatica,** *Roxb.* Gara-tiril, *K., S.*; Kalicha, Kauchia, *Or.*

A tree sometimes large but often flowering when quite small. Leaves typically narrow-elliptic or elliptic-oblong and acuminate, 4″ by 2″ to 8″ by 3·5″, but small at the time of flowering, thinly pubescent beneath when young, sec. n. 4–8 not finely reticulate between. M. fls. very small, 3–4-merous, globose, ·1–·15″, in numerous small dense peduncled cymes, axillary and from the scars of caducous scales on the new shoots, sometimes panicled on special leafless branchlets. Fem. fl. pure white, ·2″ diam. and ·3″ long, with the lobes usually erect, in distichous rows mostly below the leaves, often on special branchlets, more or less silky pubescent. Fruiting calyx with a short campanulate tube and 3–5 broadly oblong obtuse very coriaceous lobes ·3″ long usually with reflexed margins. Fruit ·5–·6″ diam., easily recognised by the 1-4 seeds of which the testa yields a crimson juice.

In the damper forests. Singbhum, along streams, rather scarce! Santal Parg., frequent in the Rajmahal! Puri, very common everywhere, often as a shrub in the laterite scrub! Angul, common near rivers! Sambalpur, rather scarce! Fl. April–May. Fr. Jan.–March. Nearly evergreen, new leaves at the time of flowering.

Attains 60 ft. by 5 ft. in girth. Bark smooth dark grey or black with lichen-white patches, blaze hard, brown then white. Leaves rather variable, the lower on a shoot sometimes oval and in the shrubby form often only 3–5″ long and not acuminate. Petiole ·3–·75″. M. cymes with peduncle ·3–·6″ long, corolla broadly campanulate or urceolate with orbicular lobes, stamens at extreme base or on receptacle. Fem. fl. with 4 staminodes. After the fall of the fruit the regularly arranged short knobbed pubescent peduncles ·15–·25″ long on short branchlets make this species easily recognisable and remain for a long time.

Var. **latifolia.** Leaves broadly elliptic 3–3·5″ broad. Sambalpur!

6. **D. ebenum,** *Koenig.* Var. acuminata, *Haines.*

A small evergreen tree with drooping branches and minutely pubescent twigs. Leaves oblong acuminate, 4–6·5″, shining above, pale, very thinly hairy and glabrescent beneath. M. fl. in peduncled

cymes at the base of the new axillary shoots or (from suppression of the shoot) in 2-nate axillary cymes. Cymes 3-fld. hairy, calyx ·15″ tubular, stamens 14–16 more or less paired with one of each pair barren. Fem. fl. on short pedicels ·2–·3″ long thickened above, divaricate, paired, bracteate, calyx obconic-tubular, corolla yellowish ·4″ long glabrous ovoid-tubular with 4 nearly straight narrow-oblong lobes ·2″ long. Fruit globose ·7″, sunk at base in the cup-shaped calyx, which has 4 reflexed distant oblong lobes.

Puri (Champagarh forest)! Angul! Fl. March–April. Fr. June.

Bark black, finely rugose, blaze brown, then orange-brown, the latter rapidly darkening on exposure. Leaves somewhat narrowed and acute or obtuse or rounded at base, sec. n. 4-8 oblique scarcely stronger than the shorter intermediate and tertiaries very reticulate. Petiole ·2–·3″. Male peduncles ·1–·4″, calyx-lobes 4, one-third to one-half as long as tube, corolla ·3″, lobes free two-thirds way down, narrow-oblong. Female calyx with 4 spreading oblong acute or broadly lanceolate lobes ·25″ long, thickened and raised into a crenulate ring round the young fruit, staminodes 8, inserted at base of corolla-tube, filaments sparsely ciliate, anthers oblong-lanceolate shorter than filaments. Ovary minutely puberulous, stigma 4-lobed. Fruit 8-celled and -seeded.

The typical *D. ebenum* gives the well-known ebony wood of Ceylon, but only small trees occur in our area and appear to differ a good deal from the type.

7. **D. chloroxylon,** *Roxb.* Gourkasa, *Or.*

A shrub or small tree often armed with stout or slender and sharp axillary thorns Leaves always more or less hairy beneath, young densely brown pubescent, only 1–2″ at time of flowering but old leaves attain 3·5″ long, elliptic or rhomboid-obovate obtuse and base rounded. Male fls. subsessile in numerous sessile capitate cymes, 4-merous, corolla white campanulate, only ·16–·15″ across with a tuft of hairs at the back of each petal. Fem. fl. solitary sessile, fruiting calyx strigosely hairy, ·3″ diam., berry ·3–·35″ diam.

Frequent in Puri, both in the Mals and the scrub jungles! Khandpara, especially on cotton soil! Fl. June–July. Fr. March–April. Evergreen. Renews leaves April–May.

Bark dark grey or black, rugose. Shoots rusty tomentose. Leaf-buds perulate, mature leaves coriaceous with about 3 sec. n. only. Petiole ·17″. Male buds globose with broadly ovate or orbicular sepals, stamens 16, glabrous, anther-slits at first sub-apical. Fem. fl. ·18″ diam., staminodes about 8, ovary glabrous. Seeds 2-3.

Gamble gives weight of wood as 46 lbs. It is apparently only used for fuel.

8. **D. melanoxylon,** *Roxb.* Inc. D. tomentosa, *Roxb.*; Tiril, Terel, *K., S.*; Tend, *Kharw.*; Kend, Kendu, *H., Beng., Or.*

A small and bushy or a large straight tree with grey- or rusty-tomentose shoots. Leaves mostly sub-opposite, 4–8″, broadly-ovate or elliptic, old coriaceous, tomentose to glabrescent beneath. M. fls. 4-6-merous in peduncled 3-12-fld. villous simple or branched often drooping cymes, buds narrowly ellipsoid ·25″ long with the tubular calyx half as long as the silky corolla or more, corolla after opening ·25–·26″ long tubular-funnel-shaped with suberect small obtuse lobes. Fem. fl. solitary axillary or from leaf-scars, subsessile or on short thick peduncles, calyx broad with edges recurved, somewhat 4–5-angled. Corolla ·3–·4″ diam., similar in shape to male, staminodes 8–10, ovary densely hairy, 4–8-celled. Fruit subsessile, 1–1·5″ diam., globose to ovoid, smooth and yellowish when ripe with thick coriaceous

fruiting calyx 1″ diam., with wavy reflexed margins to the short broad lobes.

One of the commonest trees throughout the Central and Southern Areas (I have no record of its occurring in the Northern Area nor does *Hamilton* record it from Purneah; it appears to end abruptly at the Gaya ghats) both in scrub-jungles and high-forest. Fl. May. Fruit ripens the following May. Deciduous or evergreen according to locality. It flowers on the new shoots.

Attains 6 ft. in girth with a long clean bole in some saddles of the Singbhum mountains. Bark black, rough, often in oblong plates, blaze chrome-yellow. L. vary from 2–5″ in width and from ell. to orbicular on the same branch, tip obtuse or rounded or subacute, base usually acute in form *melanoxylon*, rounded in form *tomentosa*, old with a rugose appearance above with impressed nerves in form *tomentosa*, nerves often raised in *melanoxylon*, sec. n. about 8–12 branched and irregular or forked and reticulate some distance from margin and very reticulate between. Petiole ·25–·35″. Male cymes (including peduncle) ·6–·9″ long, sometimes from axils of caducous scale-leaves on lower part of new shoots, calyx campanulate ·17–·2″ long, with acute or subacute lobes half as long as tube or less, stamens 12–16. Fruit densely hairy when young, when ripe usually 3–4-seeded rarely only 1–2- or 5–8-seeded, testa rugose shining, albumen ruminate.

Well-grown trees often yield considerable pieces of pure black ebony and it is used in Chaibassa for carving. Poles are largely used for native houses. When burnt the wood emits showers of sparks. The fruit is excellent and as one-seeded berries occur it would probably repay cultivation. The reproduction by root-suckers from any piece of root left in the ground makes it difficult to eradicate in new cultivation and suitable for purposes of re-afforestation. It is also easily grown from seed and coppice. *Gamble* gives the weight of the wood as about 68 lbs. for heartwood.

9. **D. variegata,** *Kurz* ?

A tree superficially rather resembling *D. embryopteris* with smooth bark, very large oblong or elliptic-oblong leaves mostly 10″ by 3·75″, easily distinguished by the prominent 7–8 sec. n. raised beneath, first spreading then more or less arched, nervules raised and reticulate, quite glabrous with sub-obtuse or cuneate base.

Ravines in the Rajmahal Hills but only once found by me! Fl., Fr. ?.

Blaze pink, twigs rather pustular with lenticels. Leaf-buds narrow, pointed, silky as in *embryopteris*. L. shortly acuminate, shining above, petiole ·4″. Fruiting peduncle ·2″, remaining after fall of calyx and fruit (as in *D. sylvatica* and many other *Diospyros*). The male flowers of *D. variegata* are described as in very short sparingly pubescent cymes with a salver-shaped corolla nearly glabrous without and with about 16 stamens.

Our specimen exactly matches specimens of *D. variegata* in the *Calcutta Herbarium* from Assam.

10. **D. discolor,** *Willd.*

A handsome tree with oblong leaves about 9″ long, easily recognised by being densely silvery-silky beneath with numerous slender sec. n. Fls. white ·5″ diam. in short dense cymes axillary and pseudo-terminal, sweet-smelling with very large anthers. Fruit large red velvety.

In gardens in Ranchi! Fl. April. Fr. Dec. Native of the Philippines.

11. **D. kaki,** *L.*, Persimon, is a small tree allied to *D. embryopteris*, also sometimes seen in cultivation, with ovate leaves, m. fls. in small 3-fld. cymes, solitary fem. fls. ·3–·5″ long and a globose edible fruit 1–3″ diam., reddish or yellow or scarlet when ripe. It is eaten.

Persimon is also the name of an American *Diospyros* (*D. virginiana, L.*) which is very closely allied.

FAM. 86. STYRACEÆ.

Trees or shrubs with alternate exstipulate simple leaves. Flowers regular usually white and moderate-sized, 2-sexual, in axillary and terminal simple or compound racemes or spikes, sometimes reduced to a single flower, bracts small. Calyx campanulate, superior or inferior, 5–4-toothed or truncate, persistent. Petals 6–4, usually 5, united into a short, rarely long, tube, sometimes free, imbricate. Stamens 8–10 or many with free or connate filaments often in bundles and more or less adnate to the corolla, anthers with lateral dehiscence. Ovary 2–5-celled or septa not reaching apex of ovary, style filiform, stigma small or capitate, ovules 1 or few, axile, pendulous or erect. Fruit drupaceous or leathery, 1– rarely 2–3-seeded. Seeds albuminous. Embryo straight or curved.

Stamens many, several-seriate. Fruit a drupe . . . . . 1. *Symplocos.*
Stamens 10, 1-seriate. Fruit coriaceous . . . . . 2. *Styrax.*

1. SYMPLOCOS, *L.*

Leaves toothed or entire, often coriaceous. Racemes or spikes axillary, sometimes much reduced. Flowers with 1–3 bracteoles at their base. Calyx superior, sepals 5 small imbricate. Petals 5 free or connate at base. Stamens many, several-seriate, adnate to corolla-tube and sometimes connate into a tube beyond, anthers shortly oblong. Ovary 3-, rarely 2- or 4-celled, stigma small capitate sub-3-lobed. Ovules 2 pendulous from the inner angle of each cell. Drupe ellipsoid or subglobose, 1–3-seeded. Seeds oblong. Embryo terete, axile, sometimes curved.

Leaves 2–5″. Fls. pedicelled. Fr. oblong-ellipsoid . . . . 1. *racemosa.*
Leaves 4–7″. Fls. sessile. Fr. subglobose . . . . . 2. *spicata.*

1. **S. racemosa,** *Roxb.* Lodh, *Th.*; Ludam, *K.*; Lodam, *S.*; Lodh, Lodhra, *Th., H., Beng.*; Ludho, *Or.* (sometimes Nidhu, *teste Hannah*).

A small tree with oblong, elliptic or ell.-lanceolate coriaceous leaves 3·5–5·5″ long, entire, crenate or serrulate and white flowers ·4–·5″ diam., turning yellow with age, in axillary simple or compound racemes 2–3″ long. Drupe oblong (diseased globose drupes occur) ·3–·5″ long crowned by the calyx.

Throughout the province, except perhaps along the coast from Balasore to Puri (whence I have no note of its occurrence). Common in Purneah in open jungles and grass, through Chota Nagpur to Sambalpur! Fl. Oct.–Jan. Fr. Dec.–May. Evergreen.

Bark smooth or rough, grey or in young parts pale yellowish. Leaves 1·5–2·5″ wide, glabrous or slightly pilose on the mid-rib, acute or obtuse both ends or acuminate, sec. n. slender irregular curved 5–8. Petiole ·25–·5″. Racemes pubescent or hairy pedicels ·05–·13″. Sepals ·08–·1″, broadly oblong-ovate, connate below, puberulous or glabrous. Petals connate at base. Anthers as broad as long with very small connective. Epigynous disc finely pilose. Fruit purple-black, ·17–·25″ broad. Seed and embryo straight.

The bark is used in conjunctivitis in several districts. It is also said to be used for dyeing red. *Campbell* says that the wood-ash is used as a mordant. A concoction of the leaves is used as a mordant for the Chaili (Morinda) dye in Chota Nagpur. Powdered bark also used in dysentery and other bowel complaints. *Nadkarni* states that it is found to contain several alkaloids but no tannin.

2. **S. spicata,** *Roxb.* Marang Ludham, *K.*

A small tree with very shining elliptic or oblong serrate or serrulate acuminate leaves often attaining 9″ by 3″, and white flowers ·25–·3″ diam. in simple or branched axillary spikes 1–3·5″ long. Drupe globose-ovoid ·25″ diam., crowned by the small glabrous calyx.

Along streams only. Saranda forests in Singbhum, rare! Bonai, *Cooper*! Mountain forests of Mayurbhanj, frequent esp. at elevations of 2000 ft. and over! Fl. Sept.-Oct. Fr. April. Evergreen.

Bark grey. Leaves usually about 5-6″ by 2·5″, narrowed at base, sinuately or sharply serrate except at base, pale (with microscopic white dots beneath), sec. n. 7-9 fine distinct. Petiole ·3-·4″. Spikes with pubescent rhachis and small ovate pubescent bract and bracteoles. Sepals orbicular ·04″ or less. Stamens as in last. Seed curved.

2. STYRAX, *L.*

Trees or shrubs sometimes stellately pubescent with entire or toothed leaves and white rarely pinkish subsolitary axillary or racemose flowers, bracts small. Calyx campanulate, inferior or more or less perigynous, with 5–4 teeth or subtruncate. Corolla with short tube and imbricate or valvate petals on the hypanthium. Stamens 10, mostly connate at their somewhat broadened base and adnate to the corolla tube, anthers large linear. Ovary nearly free, 3-celled below, 1-celled above, style subulate, stigma capitate. Ovules few in each cell. Fruit coriaceous (toughly chartaceous, *Clarke*), breaking up irregularly or 3-valved, 1- rarely 2-seeded. Albumen copious, embryo straight, axile or eccentric with broad or lanceolate cotyledons.

1. **S. serrulatum,** *Roxb.*

A small tree with brown twigs, stellately scurfy shoots, lanceolate or elliptic-lanceolate caudate serrate leaves 3–6″ long and white flowers which are 1–3 axillary or extra-axillary and running into terminal racemes by suppression of the upper leaves. Calyx irregularly lobed. Corolla ·5″ diam. with short tube and suberect narrowly elliptic petals ·3″ long.

Mountains of Mayurbhanj, elev. 2500 ft.! Fl. March. Fr. c.s. Deciduous Feb.

Young leaves very membranous, bright green, 3–4·5 by 1·5–2″ at time of flowering, soon glabrous except on the nerves beneath and the nerve-axils, sec. n. about 4-7 oblique fine but very distinct and reticulate. Petiole ·2-·3″. Pedicels ·2-·35″ minutely bracteate and bracteolate. Hypanthium often embracing one-third of the ovary. Petals tomentose. Filaments with expanded base tomentose, glabrous above (hairy *F.B.I.*). Ovary and young fruit white tomentose. Fruit ellipsoid ·5″ embraced by the toothed or sub-truncate calyx.

FAM. 87. OLEACEÆ.

Trees or shrubs, rarely undershrubs, sometimes scandent, with opposite (rarely alternate in *Jasminum*) simple or compound, rarely gland-punctate exstipulate leaves. Fls. regular mostly in 3-chotomous cymes or panicles rarely fascicled or racemed, 2-sexual, polygamous or rarely dicœcious. Calyx small, truncate or 5–9-, usually 4-lobed, inferior. Corolla gamopetalous but tube very short in a few genera (petals almost free in some *Linociera*), 5–9-petalous or usually 4-petalous, sometimes 0, petals valvate or imbricate in bud.

Stamens 2 on the corolla-tube (hypogynous in apetalous species), anthers dehiscing laterally or subextrorsely. Ovary free 2-celled, style short or long, stigma simple or 2-lobed. Ovules 1–2, rarely 3–4 in each cell, axile near base or apex. Fruit capsular or baccate, drupaceous or dry. Seed 1, or 1 (rarely 2) in each cell, erect or pendulous, albumen present or 0. Embryo straight, radicle superior or inferior.

I. Petals imbricate :—
  A. Fruit baccate :—
    Shrubs mostly scandent. L. simple, 3 foliolate or rarely pinnately 5-7-foliolate . . . . . 1. *Jasminum.*
  B. Fruit a dry thin-walled compressed capsule :—
    Leaves simple. A small tree . . . . . 2. *Nyctanthes.*
  C. Fruit a pyriform woody capsule :—
    Leaves pinnate. A tree . . . . . 3. *Schrebera.*
II. Petals valvate or in two pairs. Fruit a drupe. Leaves simple :—
  A. Inflorescence axillary :—
    Petals in pairs, distinct or tube very short . . . . 4. *Linociera.*
    Corolla tubular or 0 . . . . . 5. *Olea.*
  B. Panicles terminal . . . . . 6. *Ligustrum.*

1. JASMINUM, *L.* Jasmine.

Shrubs, usually scandent, rarely undershrubs. Leaves opposite, more rarely alternate, simple or pinnately 3-several-foliolate, petiole usually articulated. Flowers white, pink or yellow in 2–3-chotomous cymes very rarely reduced to a single flower, with linear and small or ovate, sometimes petaloid bracts. Calyx with funnel-shaped or cylindric tube and 4–9 sepals or truncate. Corolla salver-shaped, tube narrow, petals 4–10, imbricate in bud. Stamens included, connective usually shortly produced. Stigmas usually 2, ovules usually 2 in each cell near the base. Berry didymous of two globose or oblong carpels or of only one fleshy carpel. Seed 1 rarely 2 in each carpel, erect, exalbuminous, radicle inferior.

The species are often dimorphic with long and short styled forms, sometimes also with two quite distinct sizes of flowers. The lowest leaves on a shoot are often much smaller and of different shape to the upper ones.

A. Leaves all simple :—
  1. Scandent. Sepals over ·2″–·12″ (exc. sometimes *arborescens*) :—
    a. Longer sepals over ·3″ (in small fld. forms of *pubescens* only ·2–·3″). Corolla-tube ·4–·75″ :—
      Cymes 3-5-fld. L. glabrous or nearly so . . . 1. *sambac.*
      Cymes dense, many-fld. L. pubescent . . . 2. *pubescens.*
    b. Sepals under ·25″, usually under ·2″ :—
      Cymes rather dense. L. glabrous. Cor.-tube ·3–·35″ 3. *scandens.*
      Cymes lax. L. glabrescent. Cor.-tube ·4–·5″ . 4. *arborescens.*
  2. Shrubby, suberect or diffuse. Sepals under ·12″ :—
    Shrub. L. ovate, pubescent or glabrescent . . 4. *arborescens.*
    As in last but densely tomentose . . . . var. *Roxburghianum.*
    Undershrub. L. narrowly lanceolate . . . 5. *strictum.*
    Bushy or subscandent. Sep. minute or 0. L. small 6. *auriculatum.*
B. Leaves 3-foliolate (lateral lflts. sometimes very small) :—
  1. L. pubescent ovate ·7–2″. A garden shrub . . . 6. *auriculatum.*
  2. Glabrous. Sepals minute or obsolete :—
    Lflts. lanceolate 3–5″ long-acuminate or cordate . . 7. *caudatum.*
    Lflts. ovate 2–4″ acute or acuminate . . . . 8. *flexile.*

1. **J. sambac,** *Ait.* Vern. Mallika, Balphul, Motiya (*teste Nadkarni*).

A scandent or sarmentose shrub with pale branchlets, glabrous or nearly glabrous shining leaves, thin when dry, with numerous very

fine raised nervules, varying from broadly ovate (usually at base of shoot) to elliptic or lanceolate, with tufts of hair in the axils of the nerves beneath. Petiole ·1–·2″ always pubescent above. Flowers in 3–5-fld. terminal cymes, pedicels ·1–·3″, calyx tube ·08″, sepals filiform or subulate or 1–2 linear and the others filiform ·25–·45″, always more or less hairy. Cor.-tube ·6″, petals usually 6, ·5–·55″, narrowly or broadly oblong.

Forests of the Mals, Puri! Kuadali (Angul) in rocky ravines! Nilgiri! Fl. April–May. Very fragrant and often cultivated.

There are two well-marked varieties in our area:—

α. Twigs very slightly pubescent and glabrescent. L. at the ends of the twigs elliptic or lanceolate acute or acuminate, base obtuse rounded or narrowly cuneate on the same shoot, lower 2–3″, upper 3–4·5″, glabrous except the nerve axils. Cymes with a peduncle ·5–1·5″ long, bracts filiform ·2–·25″, petals about ·1–·15″ broad. Puri and Angul!

β. Twigs closely pubescent. L. broadly elliptic to elliptic with tip acute or very obtuse and mucronate, nerves beneath pubescent. Cymes sometimes subsessile the two lowest flowers axillary in the top pair of leaves, petals ·2″ broad, oblong minutely cuspidate.

Among rocks on hill sides, Nilgiri State!

The leaves, sometimes at least, are minutely gland-punctulate beneath.

The flowers yield a fragrant essential oil.

2. **J. pubescens,** *Willd.* Chameli, Mogra, *H.*; Binga bharbhan, *S.*

A sub-scandent shrub with drooping densely pubescent or tomentose branches, ovate or ovate-lanceolate acute or sub-acuminate leaves 1–3·5″, puberulous or with a short curly pubescence and always pubescent on the nerves beneath. Fls. white in dense-flowered capitate cymes on 2-bracteate axillary peduncles or usually terminating short axillary branches, dimorphic both in size and length of style. Calyx densely pubescent or villous-pubescent with 7–9 filiform sepals mostly ·5–·6″ (shorter ones occur on some flowers). Fruit ellipsoid ·5–·6″ surrounded by the long hairy sepals.

Purneah! Champaran! Santal P. along ravines! Ranchi ghats! Manbhum, *Camp.*! Hazaribagh, *Wood*! Often cultivated. Fl. Dec.–March. Fr. April–May.

L. as in many of the genus) very small at base of the shoots, average about 2″, base rounded, sec. n. 3–4 slender of which 1 from base. Petiole ·15–·3″. Bracts same shape as leaves. Larger flowers 1·75″ diam. shortly pedicelled, cor.-tube ·75″. Smaller fls. ·6–·7″ diam., sessile, sepals only ·15–·3″, corolla-tube ·4–·5″.

There appears to be no connection between the size of the flowers and the relative lengths of style and stamens. Both forms of flower occur in the same locality so that there is no difficulty in recognising the identity of the plant. The B. & O. plant has often rather short pubescence on the calyx and connects *J. pubescens* with *J. undulatum*, Ker., which two species should perhaps be united.

Nadkarni states that the flowers are lactifuge and the roots emmenagogue. Lactifugal properties are also ascribed to other species.

3. **J. scandens,** *Vahl.*

A rather stout sarmentose shrub or climbing by means of its recurved petiole-bases which become hardened, stems glabrous, twigs sometimes thinly pubescent. L. ovate-lanceolate coriaceous larger 5–5·5″ by 2″ acuminate, base rounded, quite glabrous, minutely punctulate beneath, sec. n. only 3 and tertiaries faint. Petioles ·5–·6″ prominently articulate, bases joined by a marked stipular often pubescent line. Cymes numerous, rather dense, axillary and ter-

minating short lateral branches, 3-chotomous, branches 3-fld. Pedicel and campanulate calyx-tube together ·15–·2″, sepals ·12–·15″, usually 6, subulate pubescent divaricate and *recurved* and often joined at base by a narrow spreading limb. Cor.-tube ·3–·35″, petals ·25–·3″, linear or linear-oblong and suddenly acute. Drupes often geminate ellipsoid black ·4″ by ·3″.

Northern and Southern Tract. Champaran! Mals of Orissa, rather common! Fl. Jan.–March. Fr. March–May.

Peduncles of cymes ·5–·6″ or those of terminal cymes with a pair of leaves at base and 1–1·5″ long.

4. **J. arborescens,** *Roxb.* Hundi, *K.*; Gada Hund Baha, *S.*; Bonomali, *Or.*

Sub-erect with a thick trunk or scandent, with young parts pubescent all over. Leaves very broadly-ovate to ovate, more rarely ovate-lanceolate, acute or usually acuminate, only 1·5–3″ in flower, attaining 5″ by 3·5″ when mature and exceptionally 8·5″ by 5·2″; sec. n. 4–8, of which 1–2 are close to base. Flowers white in lax 7-many-fld. 3-chotomous cymes. Pedicels ·2–·5″ long. Sepals linear erect or somewhat spreading straight, sometimes sub-clavate, ·04–·12″ long unequal. Corolla-tube ·4–·5″, petals often 6, linear or narrow-oblong and acuminate, ·5–·75″. Ripe carpel solitary oblong or ellipsoid, often curved, ·5″ long, nearly black.

One of the commonest Jasmines especially by the sides of rocky nalas. Gaya ghats! Santal P.! Chota Nagpur, all districts! Orissa, all districts! Sambalpur! Kalahandi ("a mass of very fragrant flowers; rocky hill-sides and dry soils." *Cooper*!) Fl. April–May. Fr. June–July. Deciduous, renews leaves in March and April.

Branches, leaves and cymes nearly glabrous in fruit. Leaves sometimes ternate, punctulate beneath, often two very small ones at the base of the shoots. Petiole ·25–·4″ or in very large leaves ·7″, articulate. First cymes sometimes 3–5-fld. only.

Var. **Roxburghianum,** *Wall.*, sp.

This is said (*Bengal Plants*) to have elliptic-oblong, often obtuse leaves persistently softly hairy both sides and minute narrowly triangular calyx-lobes. But I do not find that it consistently differs from *J. arborescens* in anything but the tomentose or softly hairy indumentum.

Hazaribagh! Also found in Upper Burmah.

5. **J. strictum,** *Haines* (*Kew Bulletin,* No. 8 of 1921).

An undershrub sending up from a woody rootstock annual strict stems 1–2 ft. high, quite erect and with no tendency to climb. Leaves mostly opposite, linear- or oblong-lanceolate gradually acuminate erect on the spreading or upcurved ·1–·2″ long petiole. Cymes more or less pubescent or puberulous terminal and from the uppermost axils, 3–5-fld.

Grassy places on the Neterhat plateau, elev. 3000 ft. Fl. May–June.

Stems minutely puberulous. L. 3–3·5″ long by ·6–·75″ broad, gland-punctate beneath with thickened margin and 8–10 slender oblique sec. nerves looped inside the margin. Bracts setaceous. Calyx-tube produced beyond the ovary, teeth unequal erect linear ·05–·1″ long. Flowers sweet-scented. Corolla-tube slender ·35–·45″ long, petals 6–10, ·4–·5″ long by ·1″ wide or less, linear acuminate. Fruit not seen.

6. **J. auriculatum,** *Vahl.* Chameli, *Vern.*

Scandent or more often in cultivation an erect bush with mostly

simple ovate leaves, but some or all the leaves will be found to have a subsidiary pair of leaflets often reduced to mere auricles, thus making the leaves 3-foliolate.

Native of Southern India and Central Provinces but often cultivated in our area. Fl. April–August. Fr. Dec.–Feb.

Twigs usually densely pubescent. L. ·7–2″, acute or obtuse and mucronate with rounded base, thinly pubescent or densely pubescent on the nerves beneath and when young, rarely quite glabrescent. Petiole ·05–·2″. Fls. ·3–·4″ diam. in rather dense cymes terminal and from the upper leaf-axils the whole forming a corymb. Sepals minute or obsolete. Cor.-tube ·3–·4″. Petals ·25″. Ripe carpels globose black ·2–·25″.

7. **J. caudatum,** *Wall.*

A glabrous climber with opposite 3-foliolate leaves with lanceolate long-acuminate or caudate leaflets, terminal 3–5″ lateral rather smaller, sec. n. 5–7 hairy in the nerve axils. Petiole ·5–1″. Fls. in very slender axillary 1–7-fld. cymes with slender peduncles and long pedicels ·3–·7″, sepals minute, being mere mucronations of the ·1″ long calyx, corolla with very slender ·75–1·1″ long (-1·25″, *F.B.I.*) tube and finely acuminate petals ·5–·7″. Ripe carpels obliquely-oblong ·45″.

Ramnagar Hills! Fl. Aug.–Nov. Fr. Feb.

8. **J. flexile,** *Vahl.*

A glabrous climber with opposite 3-foliolate leaves with ovate acute or acuminate leaflets, terminal 2–4″ lateral rather smaller, sec. n. 5–7 hairy in the nerve axils. Fls. in slender lax axillary and terminal cymes, upper paniculate, sepals minute, corolla with tube ·7–1″ and acute or obtuse petals ·5″. Ripe carpels ·3″.

Meghasani (Mayurbhanj), rare, elev. 3500 ft.! Fl. Nov.–Feb. Fr. March.

There are no better characters for separating *J. caudatum* and *J. flexile* than those given in the key, and I think they should both be united under the name of *J. flexile*, *Vahl.*

The petiole in my specimen of *flexile* is only ·3–·4″, but they are often longer than in *J. caudatum*, and apparently the plant climbs by them.

2. NYCTANTHES, *L.* (in part).

A small tree with opposite ovate leaves and mod.-sized flowers in small sessile bracteate heads disposed in terminal 3-chotomous cymes. Calyx ovoid-cylindric, sub-truncate, finally split or deciduous. Corolla salver-shaped white with an orange tube, petals 4–8 imbricate in bud. Ovule 1 in each cell, erect, basal. Fruit orbicular compressed papery or leathery, separating into 2 valves.

The germination is epigeal. The expanded cotyledons are palminerved orbicular 1″ diam. with attenuate base and a petiole ·3–·75″. The first leaves are coarsely serrate.

1. **N. arbor-tristis,** *L.* Saparom, *K., S.*; Kula marsal, *M.*; Harsinghar, *H.*; Sitik, Sephalika, *Beng.*; Kharkhasa, sihara *Gond.?* (in Sambalpur).

A small tree with usually drooping 4-angular branchlets, very scabrous ovate entire or somewhat toothed acute or sub-acuminate leaves 3–5″ long and fragrant flowers ·7–1″ diam. which open in the evening and drop next morning. Capsule ·75–1″ diam., about ·2″ thick.

N. Champaran! Very common in the hills of the Central and Southern areas, especially on steep northern slopes and along rocky ravines! On some slopes of sliding hæmatite-schist layered parallel to the surface it is sometimes the only tree, and as it coppices well is most useful for fuel. It is common as second-growth on the Rajmahal trap.

Fl. Sept.–Oct. Fr. Dec.–Jan. Deciduous April–May.

The seeds yield a medicinal oil, *Campbell*. This oil is not mentioned either by *Dutt* or *Nadkarni*, but the latter says that the powdered seeds are used in scurvy. The flowers contain an essential oil used in perfumery, and the orange tubes are used for dyeing. The leaves are sometimes used for polishing wood. The root is eaten, *Diller*.

3. SCHREBERA, *Roxb.*

Tree with opposite odd-pinnate leaves and flowers in terminal 2–3-chotomous cymose panicles with small bracts. Calyx campanulate, with 4–7 small somewhat irregular lobes. Corolla salver-shaped, petals 4–7 imbricate in bud. Stamens near top of tube. Ovules 3–4 in each cell, pendulous from its apex. Capsule obovoid or pyriform woody, loculicidally 2-valved. Seeds winged, albumen 0, cotyledons plano-convex or contorted, radicle superior.

1. **S. swietenioides,** *Roxb.* Sandapsing, *K.*; Akasara, Ekasira, *S.*; Gae-ka-lundi, *H.*; Chapsing, Ghater, *Kharw.*; Ghanto, *Uran*; Mukha, Mokha, *Or.*

A mod.-sized tree with 3–7-foliolate leaves, ovate, oblong or ovate-lanceolate leaflets 3–7″ long, pale beneath and terminal panicles of whitish flowers closely covered with brown scales and ·5–·6″ diam. Capsules drooping, pyriform, 2·5″ by 1″ verrucose with 2–4 large angular seeds in each cell.

Common in the hills of the Central and Southern areas, but rather local. Fl. May–June with the new leaves. Fr. Oct.–March. Deciduous Feb.–March.

Bark pale grey nearly smooth exfoliating in thin scales, blaze pale brownish-yellow with a rather grating or cheesy cut. Twigs pale lenticellate. Young leaves pubescent, mature 9–12″. Lflts. articulate, opp., terminal sometimes 4·5″ broad, all sub-acuminate, base narrowed into a short or very short petiolule or that of terminal lflt. 1–2″, rhachis finely pubescent, sec. n. about 8 rather strong beneath, finely reticulate between. Inflorescence pubescent subcorymbose. Corolla-tube ·5″ long. Anthers slightly exserted. Cotyledons large crumpled.

Gamble says that the wood is brownish-grey, hard, durable and of good quality, in grain rather like boxwood. Wt. about 57 lbs. *Brandis* says that it is used for the beams of weavers' looms, for combs and in turning. It is not much sought after in our province, but is used for building small houses.

4. LINOCIERA, Swartz.

Trees or shrubs with opp. entire leaves and small white flowers in axillary, rarely terminal, cymes or panicles, sometimes clustered at the ends of peduncles which are axillary or from the axils of caducous scales, bracts small. Sepals small erect united into a very short tube at base. Petals long or short, nearly free or cohering by pairs, induplicate-valvate in bud. Style short. Ovules 2 in each cell, pendulous from its apex. Fruit a drupe. Seed usually solitary with thin testa, albuminous or not, radicle or superior.

Petals caudate, cohering in pairs. L. 2–4·6″	1. *malabarica.*
Petals not caudate, connate only at base. L. 3–8″ . . .	2. *intermedia.*

1. **L. malabarica,** *Wall.* Pochandia, *Or.*

A small or mod.-sized tree with very pale twigs, glabrous elliptic, oblong or obovate leaves 2–4·5″, rounded obtuse or shortly cuspidate, rarely acute, with about 10 obscure spreading sec. n. looping within the margin. Fls. small white remarkable for the elongate caudate petals, ·2–·25″ long which adhere in pairs, clustered at the ends of axillary peduncles or of the branches of short panicles about 1″ long, or peduncles solitary from the axils of caducous scales on the new shoots. Drupe ·3–·5″ obliquely oblong, endocarp thin, seed albuminous.

Mals of Puri, in evergreen forest, frequent! Angul and Narsingpur, near nalas and ravines! Fl. March–April. Fr. the following March–April. Evergreen, renewing leaves April.

Trunk 2–5 ft. girth. Bark light grey nearly smooth roughish with lenticels, blaze rough speckled light brown, soon darkening. Leaves with a thin pale margin. Petiole thick ·15–·3″ long, brownish. Inflorescence and calyx grey-sericeous. Fls. sessile or subsessile. Sepals ovate ·05″ or less. Young fruit with minute ciliate scales.

A fine wood, very like boxwood. Wt. 65 lbs. *Gamble.*

2. **L. intermedia,** *Wight.* Suliuli-Kuda, Deori Kuda, *K.*; Musurdanta, *Or.*

A small or sometimes a large glabrous tree with leaves 3–8″, oblong ell.-oblong or almost lanceolate oblong, shortly, usually suddenly acuminate, minutely dotted beneath, base tapering or acute, sec. n. 8–10 distinct both sides but fine, usually showing pale above when fresh, looped and tertiaries very reticulate, petiole ·3–·9″. Fls. small white in axillary pyramidal panicles 2–4″ long. Drupe blue-purple pruinose oblong obtuse ·3–·7″ long, often oblique from insect puncture, exalbuminous.

Frequent near streams in the Central and Southern tracts! Singbhum! Ranchi ghats and Neterhat, elev. 3000 ft.! Santal P.! Mayurbhanj, ascending to top of Meghasani! Bonai, *Cooper*! Angul! Sambalpur! Kalahandi! Fl. Feb.–April. Fr. (takes a year to ripen) March–May. Evergreen, renews leaves at the time of flowering.

Attains 5 ft. girth with nearly smooth brownish bark and rather hard mixed white and brown blaze. Twigs pale brown often markedly lenticellate. Panicles at the base of the new shoots lax brachiate glabrous, the fls. in subsessile clusters on the branches. Sep. triangular. Petals nearly free ·15″ oblong with incurved margin.

Var. **Roxburghii,** *Clarke,* is separated by the panicles being smaller than in the type and the drupe under ·5″. The Bonai and Kalahandi plants have drupes ·7–·6″ and may therefore be considered so far typical, but there seems no sharp line of demarcation.

At the top of Parasnath is a small form which only I would refer to var. *Roxburghii.* It has erecto-patent oblong shortly suddenly acuminate leaves about 4·5″ by 1·5″ only, with weak nerves. Frt. blue pruinose ·5″ long, in my specimens *albuminous*! Possibly the endosperm is late in absorption. I have not seen the flowers, nor apparently had *Clarke,* and it might be a different species or genus.

5. OLEA, *L.* Olive.

Olea differs from *Linociera* in the longer tube of the corolla and the flowers are dicœcious or polygamous. The albumen fleshy.

The small tree occurring on the top of Parasnath referred to under *Linociera,* of which the flowers have not been seen, has albuminous seeds and may be an *Olea.*

1. **Olea dioica,** *Roxb.*

A small tree with ovate or ovate-lanceolate leaves or sometimes elliptic or oblanceolate leaves always toothed or serrate 4–7″ long and slender lax panicles of flowers with a green or white corolla is frequently found in the Tarai and Duars and might therefore be found in Purneah. It flowers in March.

6. LIGUSTRUM, *L.* Privet.

Trees or shrubs with often conspicuously lenticellate branchlets and entire leaves; the pair of small bracts in the axils belonging to undeveloped axillary shoots sometimes resemble stipules. Flowers small white in terminal panicles. Calyx small truncate or 4-toothed. Corolla tube very short or long, petals induplicate-valvate in bud. Ovules 2 in each cell, axile near the top, style rather long, stigma subclavate 2-lobed. Drupe 1–3-seeded with endocarp thin or chartaceous. Testa thin, albumen fleshy, radicle superior.

Flowers ·09–·1″ diam. Drupes ·4–·5″ long . . . . . 1. *robustum.*
Flowers ·16–·17″ diam. Drupes ·3–·35″ long. . . . . 2. *Roxburghii.*
(The smallness of the drupes in *Roxburghii* may be due to their not being fully developed.)

1. **L. robustum,** *Blume.* Haduali, *Or.*

A large shrub or small tree (or, *fide A. L. Banarjee,* sometimes a big tree), with lenticellate twigs and pubescent shoots. Leaves glabrous, distichous membranous when young, lanceolate, ovate-lanceolate or elliptic, usually narrowed both ends, sometimes acuminate, 2·5–4·5″ with about 8 sec. n., petiole ·1–·2″. Flowers very small, ·09–·1″ long just before petals spread and about ·1″ diam. after expansion, racemed and clustered on the obliquely spreading densely pubescent branches of terminal pyramidal panicles 6–10″ long. Drupes ·4–·5 narrowly oblong, often slightly oblique.

Ravines in the Rajmahal Hills, rare! Mals of Puri near streams and on hillsides to the tops of the mountains! Fl. June–August. Fr. Dec.–Jan.

Branches compressed at the nodes, often bifurcate, pubescence curly. Sec. nerves 5–8 irregular and fine, obscure beneath. Petiole articulate at the base, the two first bracts of the axillary buds often simulate intrapetiolar stipules. Calyx campanulate, ·05–·06″ long, minutely 4-toothed. Corolla-tube scarcely as long, petals oblong obtuse, ultimately spreading or reflexed. Bracts subulate, nearly equal to the ·06″ long pedicels in flower.

2. **L. Roxburghii,** *Clarke.* Haduali, *Or.*

Scarcely distinguishable from the last except by the larger flowers. The leaves seem to be usually smaller 1·5–3″, sec. n. less prominent 5–6. Panicle glabrous or pubescent, brachiate (at least in fruit). Fls. ·14″ long just before petals spread, and ·16–·17″ diam. after spreading, calyx ·06″ long. Drupes ·3–·35″ long by ·2–·25″ wide, oblong, slightly curved 1–2-seeded seated on the small 4-lobed calyx and thick ·15″ long pedicel.

Mals of Puri, Berberah!

My specimens are only in fruit, and flowers are required to make quite sure of the identification.

FAM. 88. SALVADORACEÆ.

Trees or shrubs, often spinose or with olive-grey foliage and opposite entire leaves and minute stipules. Fls. small clustered or panicled, dicœcious or polygamo-dicœcious. Calyx inferior campanulate or ovoid, 3–5-fid. Corolla gamo- or poly-petalous, 4-merous, petals imbricate. Stamens 4, hypogynous or on the cor.-tube, alt. with the petals, filaments sometimes connate. Ovary free, 1–2- or imperfectly 4-celled, style short, stigma entire or 2-fid. Ovules 1–2 in each cell, erect from the base, anatropous. Fruit a berry or drupe, mostly 1-seeded. Seed erect, globose, exalbuminous.

Corolla gamopetalous. Ovary 1-celled, 1-ovuled . . . . 1. *Salvadora*.
Corolla polypetalous. Ovary 2- or pseudo-4-celled . . . . 2. *Azima*.

1. SALVADORA, *L.*

Trees or shrubs. L. often fleshy or coriaceous. Fls. 2–1-sexual, spicate or racemose on the branches of axillary and terminal panicles with minute bracts. Calyx-lobes 4. Cor. campanulate, lobes 4 and tube sometimes with 4 small teeth between the bases of the filaments (staminodes?). Stamens 4 on the tube. Ovary 1-celled, style 0, stigma truncate. Ovule 1. Fruit a globose drupe seated on the slightly enlarged calyx, endocarp crustaceous (but see note under *S. persica*).

1. **S. persica,** *L.* Jhak, *Vern.* (*fide Prain*); Pilugach, *Or.*

A large straggling shrub or small crooked tree with spreading and weeping branches, opp. coriaceous or fleshy ell.-oblong leaves, and copious panicles of minute greenish-white flowers or small 1-seeded berries (or drupes, see note). The crushed plant, especially the fruits, has a pungent odour of cress by which it is easily recognisable.

Western Bihar, *Bengal Plants*. Mahanadi Delta, Orissa! Fl., Fr. April–May. *Roxburgh* says that it flowers and fruits all the year round. Evergreen. Renews leaves in May.

Bark deeply cracked. L. 1·25–2″ rounded both ends, sec. n. 3-4 scarcely visible; by transmitted light the chlorophyll cells appear separated by thick translucent walls. Stipules minute connected by a line. Petiole ·2–·3″. Panicles, including those from the uppermost axils, 4–8″ long with long slender opposite branches ending in the minute scattered flowers. Pedicels articulate ·05″ in flower, ·1″ in fruit. Fls. ·07″ long, sepals rounded, petals oblong-obovate with slightly inflexed tip, stamens shorter than corolla. Ovary minutely pedicelled. Berry ·2″ diam. Seed embedded in pulp with green testa and large green embryo with orbicular plano-convex cotyledons.

The bark of the root is a vesicant.

Note.—The fruit is usually described as a drupe, but in my specimens there is no sign of a hard endocarp, and *Roxburgh* describes the "berry smooth red juicy"!

2. AZIMA, *Lamk.*

Rambling shrubs with axillary thorns. Fls. dicœcious, very small sessile clustered axillary and from leaf-suppression more or less spicate or panicled, bracteoles linear. Calyx campanulate or urceolate 2–4-lobed or -fid. Petals 4 oblong, nearly free, imbricate in bud. Stamens 4, hypogynous. Ovary 2-celled, stigma subsessile, large,

2-fid. Ovules 2–1 in each cell. Berry globose, 2–1-seeded (or drupaceous with membranous endocarp).

1. **A. tetracantha,** *Lamk.* Syn. Monetia barlerioides, *L'Herit.*; Trikantajati, *Beng.* (*fide Roxb.*).

A formidably armed shrub with the thorns often 4-nate (paired in the leaf axils), hairy twigs and glabrous coriaceous leaves reminding one of a *Carissa*. L. ovate to lanceolate ("or elliptic with cuneate base"), with 1–3 sec. n. only. Fls. very small yellowish, ·07″ (*Clarke* describes them as ·5″ diam.!). Berry ·3–·5″ diam. white when ripe, 1–2-seeded.

Scrub jungles near the coast. Balasore! Puri! Fl., Fr. April–May.

Thorns straight ·6–1″ long on the twigs, lower part often green, tips needle-like. L. shining both sides, larger 2″ by 1·6″, base (in my plants) rounded, margins recurved, apex spinulose, petiole ·15″. Upper bract-leaves sparsely hairy. Calyx urceolate silky with recurved lobes. Petals green membranous oblong recurved ·1″. The berries are eaten.

FAM. 89. APOCYNACEÆ.

Trees, shrubs or, rarely, herbs, often twining and usually with milky juice. Leaves opposite or whorled or in some introduced species (*Plumeria*, *Cerbera*, etc.), alternate, quite entire simple exstipulate.* Flowers regular, 2-sexual, cymose or panicled. Calyx inferior with 5, rarely 4, imbricate lobes, often with glands at the base within. Corolla rotate or salver-shaped with lobes spreading, rarely funnel-shaped, lobes contorted and often twisted in bud (valvate in *Parsonsia*). Stamens as many as lobes, on the corolla with short filaments, anthers usually conniving over the stigma and sometimes adhering to it but not forming a column (as in most Asclepediaceæ), pollen granular. Disc often present, consisting of glands or annular or cupular. Ovary 2-celled (1-celled in the American genus *Allamanda*) or usually of 2 more or less distinct carpels united by the style, the top of which is usually enlarged. Ovules 2–many in each cell, rarely 1 only. Fruit of free or connate follicles, more rarely a berry, or drupe. Seeds often with a coma of silky hairs or winged, albumen present or not, cotyledons flat concave convolute or contorted, radicle usually superior.

The family abounds in important rubber-producing plants, especially in Africa. The juice is frequently poisonous.

I. Anthers not attached to the stigma (though often conniving round its top), anther-cells not spurred :—	
A. Ovary syncarpous, style entire at base :—	
1. Ovary 1-celled. Cultivated shrubs with very large fls.	1. *Allamanda.*
2. Ovary 2-celled :—	
Armed shrubs. Ovules few	2. *Carissa.*
Unarmed shrubs. Ovules many. Only occasional in gardens	*Melodinus* (p. 535).
B. Ovary with the two carpels often appressed but distinct (sometimes united below in *Rauwolfia*) in flower, style split at base :—	
1. Leaves alternate :—	
a. Ovules few in each carpel. Frt. drupaceous or baccate :—	

* But sometimes with a stipular line and stipule-like glands.

Calyx glandular. Flowers large yellow . . . 3. *Thevetia.*
Calyx eglandular. Fls. white or red . . . *Cerbera* (p. 536).
b. Ovules many. Fruit follicular . . . . . 5. *Plumeria.*
2. Leaves opposite :—
a. Ovules 2 only in each carpel. Frt. sub-baccate . 4. *Kopsia.*
b. Ovules many in each carpel. Fruit follicular :—
i. Herbs or undershrubs. Fls. white or pink . . 6. *Vinca.*
ii. Trees or shrubs. Flowers white :—
Calyx glandular. Follicles stout fleshy . . 7. *Tabernæmontana.*
Calyx eglandular. Follicles long slender . . 8. *Holarrhena.*
3. Leaves whorled :—
Shrubs or undershrubs. Ovary sub-syncarpous. Frt. drupaceous . . . . . 9. *Rauwolfia.*
Trees or shrubs. Ovary apocarpous. Frt. of slender follicles . . . . . 10. *Alstonia.*

II. Anthers adhering to the stigma by a point on the connective (usually leaving a drop of latex when torn away), anther-cells produced downwards into a subulate empty spur :—
A. Mouth of corolla with scales :—
1. Erect trees or large shrubs. Fls. white or coloured :—
L. whorled. Anthers included . . . . . 11. *Nerium.*
L. opposite. Anthers exserted . . . . . 12. *Wrightia.*
2. Climbers. Fls. pale-coloured, petals caudate . . 13. *Strophanthus.*
B. Mouth of corolla without scales. Climbers :—
1. Anthers more or less exserted. Carpels more or less connate in flower :—
Lobes of corolla linear-oblong, valvate . . . 14. *Parsonsia.*
Lobes of corolla broad, contorted . . . . 15. *Vallaris.*
2. Anthers included :—
a. Flowers very large, white :—
Corolla campanulate. Carpels connate . . . 16. *Beaumontia.*
Corolla salver-shaped. Carpels not connate . . 17. *Chonemorpha.*
b. Corolla mod.-sized or small :—
i. Tips of corolla-lobes not deflected in bud :—
Fls. m.s., sepals long . . . . . 18. *Aganosma.*
Fls. small, sepals minute . . . . . 19. *Anodendron.*
ii. Corolla lobes deflexed at the tip in bud :—
Flowers very small, follicles very slender . 20. *Ichnocarpus.*

1. ALLAMANDA, *L.*

Shrubs, usually climbing, sometimes small trees, with opposite and whorled leaves, entire and shortly petioled with intra-petiolar glands. Flowers very large, usually yellow, in few-fld. terminal and axillary cymes. Corolla with a short tubular base, then suddenly campanulate, lobes rounded contorted to the left, throat with a ring of ciliate scales. Ovary 1-celled with 2 parietal placentæ and many ovules. Fruit globose with numerous stout green prickles, finally 2-valved.

An American genus of which there are now several species common in gardens in our province. The most frequent is probably **A. cathartica,** *L.*, with very large yellow flowers 3-4″ across. It is a climber, but often seen sub-erect from being pruned.

2. CARISSA, *L.*

Thorny, often 2-chotomously-branched shrubs, often scandent, with opposite coriaceous leaves and milky juice. Flowers small or m.s., white or pinkish, in 3-chotomous cymes. Calyx 5-partite. Corolla salver-shaped, throat naked, lobes overlapping to right. Stamens at top of tube, included. Disc 0. Ovary 2-celled, style filiform, stigma

large, minutely 2-fid. Ovules 1–4 in each cell. Berry 2-, or by abortion, 1-celled. Albumen fleshy, cotyledons ovate.

Note.—In the *Indian Forester* for July, 1919, there are figures of the species here dealt with, but at the time of writing that article it was not known that the Linnean *C. spinarum* is really *Roxburgh's C. diffusa*; the synonymy of the species as named in that article is therefore given below.

I. Cells of ovary 1-ovuled. Leaf-nervation obscure . . . 1. *paucinervia*
II. Cells of ovary 2-ovuled. Leaf-nervation distinct:— [(*opaca*).
A. L. never acuminate, apiculate. Thorns straight:—
Diffuse shrub. L. broadly ovate, venose, ·6–1·6″. Cor.-tube ·4–·55″. Petals ·2–·4″ . . . . . 2. *spinarum*.
Scandent shrub. L. ovate to oblong, 1–2″. Cor.-tube ·5–·6″. Petals ·3–·4″ . . . . . var. *scandens*.
B. L. acuminate, not mucronate. Thorns often curved . . 3. *inermis*.
III. Cells of ovary 4-ovuled. Leaves elliptic or oval with rounded ends . . . . . 4 *carandas*.

1. **C. paucinervia,** *A.DC.* Inc. C. opaca, *Stapf*, and C. gangetica, *Stapf*.* Syn. C. spinarum, *Lamk.* (*non L.*); C. spinarum, *F.B.I.*, and of most other authors in whole or in part; C. spinarum, *typica*, and C. spinarum, *var. paucinervia, Haines*, in *Ind. Forester, loc. cit.*, figs. 2 and 3; Kanuwan, *K.*; Karwah-janum, Karwat', *S.*; Jangli Karaunda, *H.*

A rigid 2–3-chotomously branched erect shrub, sometimes sub-arboreous, with pairs of divaricate straight often forked thorns 1–2″ long. Leaves ·5–1·8″ from narrowly elliptic-oblong to broadly ovate, acute and apiculate, with usually acute or rhomboid base, pale beneath, sec. n. 2–3, rarely 4, faint when fresh (sometimes conspicuous in the herbarium). Petiole ·07–·15″. Flowers small white star-like, very slender in usually 2-nate terminal lax puberulous cymes with peduncles up to 1″. Corolla-tube ·25–·35″, petals ·2–·3″ acuminate. Ovules 1 only in each cell. Fruit ellipsoid to sub-globose, ·25″, black when ripe.

Common in the dryer and less forest-covered tracts. Gaya! Monghyr, *Ham.*! Hazaribagh! Ranchi, chiefly near the ghats! S.P. in the west! Manbhum in the north! Sambalpur, rather scarce! Fl. March–May and sporadically up to September. Fr. Nov.–Dec. and onward to March. Evergreen. New shoots March.

Rarely diffuse (var. *hirsuta*). Twigs glabrous, puberulous or very pubescent when young. L. usually ovate with rhomboid base, but basal angle of lower larger leaves wide, more rarely leaves (typical *paucinervia*) narrowly ellipsoid or lanceolate-rhomboid, usually glabrous. Cymes rarely solitary, or sessile or axillary. Sepals ·07–·08″. Petals narrowly linear-lanceolate, often puberulous. Anthers near top of tube.

Stapf (m.s.) divides the species into three, as follows:

a. **paucinervia,** *A.DC.* L. lanceolate, acute, 2·5-3 cm. by 1-1·5 cm. Corymbs 3–5-fld. Cor.-tube 7–9 mm., lobes 3–4 mm.

* Since writing the above I have learnt from *Mr. Gamble*, who knows the typical *C. paucinervia* in the Nilgherries, that that species is really quite distinct, and that the plants so named from Monghyr and other plains localities in *Herbaria* (see also *F.B.I.*, iii, p. 631) are errors of identification. If it be conceded that these latter are *not C. paucinervia*, then one of the chief reasons for my uniting *opaca* and *gangetica* under varieties of *paucinervia* disappear and our plant should be called *C. opaca, Stapf.*, as I understand will be done in the *Flora of Madras*. *Mr. Gamble* also keeps variety *gangetica* distinct. This requires further investigation in the field.

If *C. paucinervia* is really distinct, then the shrub so named officially, growing in the Calcutta Botanic Gardens, must also be an error of identification.

Monghyr, *Ham.*! Occasional in Chota Nagpur! but the type is from the Nilgherries.

β. **opaca,** *Stapf.* L. broadly ovate-elliptic to elliptic-oblong. Branchlets pubescent to tomentose. L. broadly ovate-elliptic to ell.-oblong, 1·5–3·5 cm. by 1–2 rarely 2·5 cm. Cor.-tube 7–8 mm., lobes 5–7 mm.

This is one of the common forms originally usually recognised as *C. spinarum*. It apparently includes var. *hirsuta*, of *Herbaria* (*Ind. For., l.c.*, p. 387), which is sometimes diffuse or sub-erect and often with pubescent leaves when young. This occurs in Hazaribagh, *Wood*! and occasionally in other parts of Chota Nagpur.

γ. **gangetica,** *Stapf.* Branchlets glabrous. L. 3–5 cm. by 1·5–3 cm. Cor.-tube about 78 mm., lobes 4–6 mm.

The commonest form in our area. But the size of the leaves is immensely variable on the same plant, and I do not think it is separable from *opaca* even as a variety.

The leaves are used for tanning. The fruit is eaten.

2. **C. spinarum,** *L.* Syn. C. diffusa, *Roxb.* (*Ind. For., loc. cit.*, figs. 4 and 5); C. spinarum, *F.B.I.* in part only; Anku-koli, San Karenda, *Or.*

A dwarf shrub with very numerous diffuse or sub-erect branches, or scandent. Branches subglabrous or usually pubescent with straight simple or forked divaricate thorns. L. ·6–2·5″ broadly ovate to broadly oblong with sub-cordate or rounded base, very shining, with 3–6 sec. n. conspicuous and raised above when dry, spreading and then arched or looped well forward and reticulating with several shorter ones from the midrib, apex acute or obtuse and apiculate. Petiole 0–·08″. Fls. in close terminal or axillary pubescent sessile or shortly peduncled, often many-fld. cymes; corolla-tube ·4–·55″ thinly pubescent, anther-swelling above middle of tube; petals ·3–·4″ or only ·2″, oblong or oblong-lanceolate, not acuminate. Ovules 2 in each cell. Fruit ovoid or elliptic.

Orissa, from Balasore southwards, not far from coast! Very common in the laterite scrub jungles.

The two following forms may be distinct species, but are more probably one depending upon locality, whether in the open or with other forest growth, and especially upon the prevalence or otherwise of browsing.

α. **diffusa** = the type in the Linnean herbarium. Dwarf (perhaps from the sarmentose shoots always being browsed). L. nearly all ovate ·6–1·6″ only. Cymes congested subsessile. Corolla-tube ·4–·55″. Berry ·3–·4″. Seeds usually 4. (*Ind. For., loc. cit.*, fig. 4.)

β. **scandens.** Widely scandent with long straight thorns 1″ or more on the branches. L. 1·5–2·5″ very obtuse or subacuminate with petiole ·1″ long. Cor.-tube ·5–·6″, lobes ·3–·4″ lanceolate. Berry nearly ·5″, usually 2-seeded. The pedicels and flowers sometimes pink. (*Ind. For., loc. cit.*, Plate 19, fig. 5.)

Same localities but in the forests, whereas the first occurs only in scrub.

3. **C. inermis,** *Vahl.* Syn. C. Dalzellii, *Bedd.*; C. macrophylla, *Wall*; C. suavissima, *Bedd.*? (*Ind. For., loc. cit.*, figs. 6 and 7); Kerenda, *Or.*

A very stout woody climber with large conical thorns on the trunk and nearly straight or usually somewhat curved divaricate thorns ·5–·7″ long on the branches. Twigs glabrous. L. less coriaceous than in the other species, lanceolate or broadly or narrowly ovate,

acuminate, 2–3·5″ or sometimes 4·5″, tip scarcely mucronate, base very obtuse or rounded or cuneate on the petiole, sec. n. 2–3 from near the base and 2–3 weaker ones above, all rather indistinct. Petiole ·15–·2″. Cymes contracted, terminal and axillary, subsessile 3-fld. or 3-chotomous, pedicels ·15″. Sep. subulate acuminate or tip setaceous, ciliolate ·1″. Cor.-tube ·75–·9″ glabrous, petals 5–6, lanceolate-oblong or linear ·5–·7″ with slender acuminate tip. Ovules 2 in each cell. Berry globose ·7″ diam. (unripe?).

Mals of Orissa, sometimes on the tops of the hills, in the forest! Fl. April. Fr. May.

This agrees neither with the description in the *F.B.I.* of *C. macrophylla*, nor of *C. suavissima*, *Bedd.*, but it matches *Wallich's* No. 1679*c*. The climbing habit and globose fruit separates it from *macrophylla* of *F.B.I.*, the smaller flowers and the smaller fruit and strong thorns from *suavissima*, but the Oriyas say that the fruit sometimes does attain 1″.

Var. **inermis** proper (*Ind. For.*, fig. 7).

L. ovate, with cuneate or rounded base.

Var. **macrophylla** (*Ind. For.*, fig. 6).

L. lanceolate acuminate, base cuneate.

Var. **Dalzellii.**

This is described as an erect shrub without spines between the leaves of the flowering branchlets. L. ovate to ovate-lanceolate, long-acuminate, usually acute at the base, quite twice as long as broad. The habit appears to be the only tangible difference, and this requires confirmation.

4. **C. carandas,** *L.* (*Ind. For., loc. cit.*, fig. 1).

A large shrub or small crooked tree with rigid dichotomous branches and pairs of divaricate very strong often forked thorns 1–2″ long. Leaves 1–3·5″ broadly elliptic-oblong or oblong with *rounded* or very obtuse sometimes retuse ends, usually muticous, green both sides, sec. n. 4–8 looping and connected with intermediate and tertiaries, raised above when dry and distinct, petiole ·1″. Fls. in rather lax usually binate terminal peduncled cymes with peduncles up to 1″; pedicels often slender and ·2″ long; corolla tube ·6–·7″; petals oblong, ·4–·5″. Ovules 4 in each cell. Berry ellipsoid, ·5–·7″, or in cultivation 1″, 4 or more-seeded.

Very commonly cultivated in all districts for its fruit.

Melodinus monogynus, *Roxb.*, is a large climber with Jasmine-like flowers and an apple-like fruit. It is native not far from Purneah and is sometimes cultivated in gardens.

3. THEVETIA, *Juss.*

1. **T. neriifolia,** *Juss.* Pila Kaner, *H.*; Zurd, *Kanel*; Kokla-phul, Champa, *Vern.*; Konyar-phul, *Or.*; Berenjo, *S.*

A large evergreen shrub or small tree with crowded alternate 1-nerved linear leaves and large yellow funnel-shaped flowers 1·5–2″ diam.

The pericarp of the fruit when nearly rotten easily breaks into 2 valves and the endocarp also finally breaks into 2 valves before germination.

Common in all gardens and semi-wild in the Maniband f rest in Khurda! Fl. Fr. most of the year. Native of tropical America.

L. 3–5″ tapering both ends, glabrous, margin revolute. Cymes sub-terminal shorter than the leaves, few–1-fld. Ovary of two more or less connate carpels flat on their inner faces. Ovules 2 in each carpel. Drupe sub-globose, green.

It is easily grown from seed and is of very quick growth.

4. KOPSIA, *Blume.*

Glabrous trees or shrubs with opposite leaves. Flowers in terminal cymes. Calyx 5-partite, eglandular within but sepals with glandular tips. Corolla salver-shaped, tube very slender, throat hairy. Stamens near the top of the tube. Disc of 2 glands. Carpels distinct, style thickened at top. Ovules 2 in each carpel, 1 on either side of a thick placenta. Fruit of 2 short stout coriaceous or rather fleshy carpels, each 1-celled or 2-celled by the intrusion of the placenta.

1. **K. fruticosa,** *A.DC.* Syn. Cerbera fruticosa, *Ker.*

A large spreading evergreen shrub, bearing large handsome lanceolate leaves and very pretty rose-coloured flowers somewhat resembling those of *Vinca rosea.*

Native of Burma, often cultivated.

Cerbera odollam, Gaertn., is a large shrub or small tree wild in the Sunderbans and Chittagong and possibly occurring in the Mahanadi delta. Cerbera has scattered alternate leaves and funnel-shaped corolla and the fruiting carpel or carpels has a thick fibrous and woody pericarp.

5. PLUMERIA, *L.*

Small trees with very thick branchlets scarred with the bases of the fallen petioles. Leaves alternate large, entire, deciduous, with numerous secondary nerves spreading almost at right angles to the mid-rib and joined in an intramarginal nerve. Flowers showy in terminal corymbose cymes, in pairs in the axils of large caducous bracts. Calyx perigynous, sepals 5, broad, obtuse. Corolla funnel-shaped with a slender tube and 5 large oblong petals. Anthers subsessile at the base of the tube. Ovary almost inferior, of 2 ovoid carpels adherent by their backs to the torus, and connected only at the apex by the swollen stout style with mitriform stigma. Ovules many. Fruit of two stout follicles. An American genus.

1. **P. acutifolia,** *Poir.* Gulachin, Gulchin, *Vern.*; Gulainchi, *H.*; Gulanj baha, Champa pungar, *S.*; Pagoda Tree; Spanish Jasmine.

Leaves oblong but more or less tapering both ends, 8–12″ long. Flowers white with a yellow centre, very fragrant in short umbellately divided cymes on a long peduncle, petals obovate-elliptic, 1·5″ long; tube ·5–·7″, hairy within.

Very common in gardens. Deciduous in the c.s. Fl. h.s. and r.s.

2. **P. alba,** *L.*

Leaves darker green, obtuse, with narrowly revolute margin. Fls. subspicate on the branches of the corymbose panicle, pure white. Petals 2″ oblanceolate with rounded tip.

Frequent but less common than the last.

3. **P. rubra,** *L.* Frangipani, *Vern.*

Bears dense heads of pretty red flowers.

All the species are sometimes called *Frangipani*. There are others in cultivation but less common. All are easily raised from cuttings.

6. VINCA, *L.* Periwinkle.

Herbs or shrubs with opposite entire leaves and axillary flowers. Calyx 5-partite with narrow sepals. Corolla salver-shaped, throat constricted, tube with reflexed hairs below the included stamens. Disc of 2 large glands. Carpels distinct, style with thickened top and annulate viscid stigma sometimes with a reflexed membrane. Ovules 6 or more in each carpel. Follicles 2, slender. Seeds truncate each end.

Leaves lanceolate. Fls. ·25″ diam. . . . . 1. *pusilla.*
Leaves ovate to obovate. Fls. 1–2″ diam. . . . . 2. *rosea.*

1. **V. pusilla,** *Murr.*

A small erect herb 6–15″ high with acutely 4-angled stems. Leaves 1–2·5″, lanceolate acuminate with minutely scabrid edges, otherwise glabrous, stipular glands subulate, petiole ·2–·25″, slender. Flowers white, sepals ·15″ filiform. Corolla-tube ·3–·4″ long, swollen above. Follicles 2–3″ long, very slender, diverging, membranous.

Frequent in cultivated land. Chota Nagpur! Fl., Fr. r.s.

2. **V. rosea,** *L.*

A beautiful herbaceous or somewhat suffruticose plant 1–2 ft. high with deep green polished oval, obovate or oblong leaves and pure white or deep rose-coloured flowers usually paired and sessile in the axils. Base of petiole 2-glandular. Corolla 1–2″ diam. Follicles ·9″ long.

Very common in gardens. Fl., Fr. all the year round, and often self-sown. Probably native of America.

7. TABERNÆMONTANA, *Br.*

Trees or shrubs. Flowers white in axillary and terminal cymes. Calyx 5-lobed or -partite, glandular within, rarely eglandular. Corolla salver-shaped, petals oblong or suborbicular. Stamens about middle or below middle of the tube. Disc 0. Carpels distinct, style with top urceolate ovoid or clavate, stigma short or long, 2-lobed. Ovules usually many and many-seriate. Follicles ovoid or oblong, often curved, dry coriaceous or fleshy with the seeds buried in pulp, grooved on one face, smooth striate or rugose. Albumen fleshy, sometimes ruminate. Cotyledons ovate, radicle long or short.

1. **T. coronaria,** *Br.* Syn. Ervatamia coronaria, *Stapf*; Chandni, *Vern.*; Tagar, *H.*

A very handsome bushy shrub with dark green foliage paler beneath and pure white flowers.

Very commonly cultivated and apparently wild in Purneah! This is not unlikely, as I have found it undoubtedly wild in Sikkim and the foothills of Sikkim and Bhotan. The *F.B.I.* says that the native country is unknown! Bettiah, *Hieronymus* (wild?)! Fl. h.s. and r.s. Fr. c.s. Evergreen.

Leaves glabrous shining mostly unequal in each pair, the larger 4–5″ long, oblong-oblanceolate acuminate or caudate, rarely obovate, sec. n. fine, 5–6, petiole ·25–·4″, axils glandular. Flowers 1·5–1·8″ diam. Calyx ·1″ long only with obtuse or rounded lobes. Cor.-tube ·8–1″ slender, petals obliquely obovate, or ovate-oblong obtuse, rounded in the wild form, sometimes acute in the cultivated. Follicles 1·5–2″ long, spreading and recurved, coriaceous, sessile or stipitate, turgidly oblong, 3–7-ribbed, inside orange or red and seeds with a fleshy red aril.

A double-flowered form is very common in gardens. The flowers have no scent by day but are sometimes fragrant at night.

8. HOLARRHENA, *Br.*

Trees or shrubs. Flowers white in terminal or subaxillary corymbose cymes. Calyx usually glandular within, lobes small. Corolla salver-shaped, throat contracted, naked, petals overlapping to the right. Stamens near the base or low down in the tube, anther-cells rounded at the base. Disc 0. Carpels 2 distinct, style short, stigma oblong-fusiform entire or 2-toothed, ovules many. Follicles 2 long slender, terete. Seeds linear or oblong, compressed concave with a coma. Albumen scanty. Cotyledons complicate broadly ovate palminerved, hypocotyl long on germination which is epigeal.

1. **H. antidysenterica,** *Wall.* Koriya, *Th.*; Dudhia (Monghyr), *Vern.*; Kuar, Tuar, *K.*; Hat, *S.*; Kurchi, *H., Beng.*; Koraiya, *Kharw.*; Korkoria, *Uran.*; Kurdu, *Mal P.*; Samoka, *Gond.*; Kure, Kuda, Khurni, *Or.*; Khorhoi, *Khond.*

A large shrub or small tree with somewhat distichously spreading subsessile ovate to elliptic-oblong leaves 6–12″ by 1·5–5″, strongly nerved beneath and terminal corymbose cymes 3–6″ wide of sweet-scented white flowers ·75–1·5″ diam. Follicles slender divaricate 6–9″ (16″, *F.B.I.*) long by about ·16″ broad. Seeds (Indra-jao, Inderjao, *H.*) linear-oblong, ·5″ long, with a long brown coma.

Very common in all districts. Sometimes sub-gregarious. Frequent on the Khurda laterite, but usually prefers damp localities. Fl. May–July. Fr. Dec.–Feb. Deciduous Feb.–April. It flowers on the new shoots.

Bark thick smooth. Blaze brownish exuding latex from the layer next the wood. Twigs and leaves glabrous, pubescent or tomentose. L. with a rounded apex or obtusely acuminate, base usually obtuse or rounded, the first pair of leaves on a twig are usually broadly elliptic and only 3″ long, sec. n. 8–13. Sep. ·1″. Cor.-tube ·4″ pubescent, petals ·5–·6″ or longer.

The bark and seeds are an excellent cure for chronic dysentery. A case in Singbhum of nearly a year's standing was cured in a few weeks. The leaves are distasteful to cattle and goats.

9. RAUWOLFIA, *L.*

Shrubs or undershrubs with 3–4-nately whorled, rarely opposite leaves which have glandular axils. Fls. rather small, white or pink, in 3–4-nate terminal cymes alternating with the leaves and sometimes becoming lateral through the growth of the branch in fruit. Calyx eglandular within. Corolla tubular-funnel-shaped or salver-shaped, sometimes sub-irregular, throat usually densely hairy within and concealing the anthers in the tube, lobes overlapping to the left. Disc large cupular or annular. Carpels distinct or connate. Style filiform, stigma broad calyptriform at the base, tip 2-fid. Ovules 2

collateral in each carpel. Ripe carpels drupaceous, distinct or connate, usually 1-seeded. Seeds ovoid, albumen fleshy, cotyledons flat.

Glabrous. Leaves mostly over 4″ . . . . . 1. *serpentina.*
Pubescent. Leaves mostly under 4″ . . . . . 2. *canescens.*

1. **R. serpentina,** *Benth.* Chandra, *Beng.*; Patalgarur, *Or.*

A pretty glabrous undershrub 1–2 ft. high with bright green shining opposite and 3–4-nately whorled oblong or obovate rather membranous leaves 3–7″ long, and small white flowers with pink tubes in terminal peduncled bright red cymes. Drupes polished green and finally black ·25–·5″ diam.

In grassy usually damp places. Singbhum rare! Puri! Angul, *Chattarjee.* Fl. May–July. Fr. July–Sept. Sometimes also seen in gardens in flower and fruit at other times.

Leaves acute or acuminate with 8-12 slender sec. n., paler beneath, petiole ·25–·7″ long. Peduncle 2–3″ long. Pedicels bright scarlet. Bracts minute subulate. Corolla-tube slender ·7–·9″ long, often curved, petals about ·2″. Anthers a little above the middle of the tube. Endocarp slightly rugose.

A reputed cure for snake-bite.

2. **R. canescens,** *L.*

A spreading 2-chotomously branched shrub with pubescent branches, 3–4-nately whorled leaves, very small white flowers and pretty red berries.

Orissa, near Cuttack, etc., apparently an escape from cultivation! Fl., Fr. April–June. Native of West Indies.

L. usually in two unequal pairs in a whorl, larger 2·5–3·5″, smaller about 1″, ell.-oblong or ell.-obovate, softly pubescent, not shining, acute, sec. n. about 12, very fine spreading, petiole ·1–·25″ with subulate glands. Fls. in 3–4-nate cymes, at first terminal, peduncles ·2–1″ long usually 3–5-fld. Calyx urceolate pubescent. Cor.-tube pubescent ·2″ long, lobes rounded, one-fourth the tube. Ovary entire slightly 2-lobed, cells 2-ovuled. Fruit ·25″ diam. globose, containing 2, 1-seeded stones, seated on the spreading somewhat enlarged calyx.

10. ALSTONIA, *R. Br.*

Trees or shrubs with 3–4-nately whorled leaves and mod.-sized flowers in subterminal corymbose cymes. Calyx short. Corolla salver-shaped, throat naked, annulate, or with reflexed hairs. Stamens near the top of the tube, included, anthers subacute. Disc sometimes 0. Carpels distinct, style with ovoid or oblong top and minute or 2-toothed stigma. Ovules many, and many-seriate. Follicles 2, linear, slender, distinct. Seeds oblong or linear, flattened, peltately attached, often ciliate, albumen scanty, cotyledons oblong, flat.

A. Leaves with close parallel secondary nerves. Petals overlapping to left:—
Tree. L. obtuse or obtusely acuminate . . . . . 1. *scholaris.*
Shrub. Leaves finely acuminate . . . . . 2. *venenatus.*
B. Leaves with distant nerves. A tree, cultivated only . . . 3. *macrophylla.*

1. **A. scholaris,** *Brown.* Kununung, *K.*; Chatni, *S.*; Chatawan, *H.*; Chatina, *Or.*; Chhatanda, *Gond* (? Angul).

A large usually straight handsome tree with the branches and leaves whorled, leaves 3–7 usually 6 in a whorl, 4–8″ long, whitish beneath. Flowers greenish-white in umbellately branched cymose panicles. Fruit of two slender pendulous follicles 1–2 ft. long.

In the damper districts throughout the province, never very common. Purneah! Chota Nagpur, in valleys, not common! S.P., in valleys! Puri! Angul!

Orissa States, fairly common, *Cooper*. Narsingpur! Fl. Nov.-Jan. Fr. r.s. Evergreen.

Attains 6 ft. girth. Bark nearly smooth, blaze moderately hard, mottled brown and cream, then white with a copious flow of milk. L. glabrous oblanceolate to obovate obtuse or retuse (or obtusely acuminate, *F.B.I.*), narrowed into a ·25–·5″-long petiole, sec. n. very numerous close horizontal. Inflorescence puberulous, peduncled or sessile, branches 2–4″ with often 2–3 whorls of secy. branches ·25–1″ long and flowers subcapitate at the ends. Corolla ·3–·5″. Disc 0. Ovary hirsute. Follicles ·12″ diam. terete, clustered. Seeds ·3″.

"The wood is not durable but is easily worked. It is used for boxes, furniture, scabbards and other purposes. Wt. about 28 lbs. per c. ft.," *Gamble*. It used to be occasionally sold for tea-boxes in the Duars. The bark is described (*Dutt*) as tonic, alterative and useful in fever and skin diseases.

2. A. venenatus, *R. Br.*

A shrub sometimes 20 ft. high with numerous erect stems and mostly 3-nately whorled, linear or oblong-lanceolate long-acuminate leaves 4–12″ long. Flowers pure white in terminal 2-chotomous cymes much shorter than the leaves. Calyx glabrous with ciliate sepals, very small. Corolla tube very slender ·75–1″ long with the anther swelling near the top, petals ·5″. Follicles slender terete 3·5–4″ long by ·2–·25″ wide in middle, tapering both ends and with a long beak ·7–1″ long.

Ravines in the Angul hills, rare! Kalahandi, *Cooper*! Fl. April-May also July. Fr. Feb.-May (it probably flowers at various times and fruits soon after).

Bark delicately rugose, blaze green, greenish-yellow and white. The green is much more diffused in the bark than in most trees.

Leaves with very numerous spreading strong sec. parallel nerves united in an intra-marginal one, softly hairy beneath but more or less glabrescent with age.

3. A. macrophylla, *Wall.*

A small or large tree with oblanceolate 4-nately whorled leaves 9–12″ long and white fragrant salver-shaped flowers in corymbose cymes. Cor.-tube ·2″ long, petals oblong nearly as long as tube, ciliate. Follicles 9–12″ slender.

Introduced, native of Penang, Java, etc., now frequently seen in gardens, where it flowers as a small tree.

Leaves with about 20 sec. n. reaching nearly to the margin and then running nearly parallel with it, hairy beneath, petiole short. Calyx pubescent ·04″ with broadly ovate lobes. Seeds oblong ·25″ brown-tomentose and bearded with long brown hairs, peltately attached to placenta.

11. NERIUM, *L.* Oleander.

Glabrous shrubs with 3–4-nately whorled, rarely opposite, narrow coriaceous leaves with numerous close slender spreading sec. n. Flowers large in racemose cymes. Calyx glandular within. Corolla salver-shaped with a narrowly funnel-shaped tube, throat with 5 broad toothed or fimbriate scales opposite the petals which are obovate and overlap to the right but twisted to the left. Stamens at the top of the tube included, anthers sagittate adhering to the stigma, tips filiform, cells with long spurs furnished with twisted hairs. Disc 0. Carpels distinct, many-ovuled, stigma with a basal reflected lobed membrane surmounted by 5 tubercles, tip subglobose. Follicles long cylindric straight hard appressed. Seeds oblong, villous with terminal coma.

L. linear or linear-lanceolate, flowers odorous, sepals erect . . 1. *odorum*.
L. lanceolate. Flowers inodorous. Tips of sepals often patent . 2. *oleander*.

1. **N. odorum,** *Soland.* Kaner, Kanel, Karpad, *H.*; Karabi, *Beng.*; Rajbaha, *S.*

A beautiful well-known shrub with usually erect (in the wild form often prostrate, ascending, perhaps from the rush of water) rod-like branches and narrow leaves tapering each end. Flowers 1–1·5″ diam. usually rose or white, fragrant, in terminal cymes.

Wild in stream beds of the United Provinces and Deccan but not in our area, very common in gardens. Fl., Fr. most of the year in cultivation. I have only seen the wild plant flowering in the h.s. and r.s. and fruiting c.s.

Follicles 7″ by ·3″.

2. **N. oleander,** *L.*

The true *Oleander* of the Mediterranean region appears to be sometimes found in gardens. The chief points of difference are those in the Key. A further difference appears to be in the depressed 2-fid, less umbonate stigma according to *De Candolle.*

12. WRIGHTIA, *Br.*

Trees or shrubs with the milky juice white or yellow, opposite leaves and m.s. fls. in terminal or sub-axillary sessile cymes. Calyx short, 5-partite, with glands or scales inside. Corolla salver-shaped with usually short tube and throat with 1–2 series of scales. St. at top of tube, fil. short dilated, anthers exserted, sagittate, adhering to stigma, cells spurred at base. Disc 0. Carpels free or connate, many-ovuled, stigma ovoid with usually a toothed basal ring. Follicles distinct or connate or adherent by both ends. Seeds linear, compressed, tip narrowed, naked, base with a deciduous coma, albumen scanty or 0. Cotyledons broad, convolute; radicle short, superior.

L. 4–10″, sometimes glabrous. Corona white. Follicles only connate at tip or free . . . . . 1. *tinctoria.*

L. 3–5″, never glabrous. Corona coloured. Follicles connate . . 2. *tomentosa.*

1. **W. tinctoria,** *Br.* Kapar, *Rajwari*; Khirna, *Kharw.*

A small, usually crooked tree, with the milky juice white, subsessile elliptic-oblong, obovate or oblanceolate leaves with a sudden short blunt acumination, 4–10″ long (but always quite small at the time of flowering). Flowers white, pretty, ·75–1″ diam., conspicuous for their corona of scales cut into linear segments and exserted cone of yellow anthers. Follicles 10–20″ long, always curved and cohering at the tip until nearly ripe, slender.

Always on rocky ground and not common in our area. Palamau, Kechki and Betlah forests! and near Deltonganj in scrub jungles! Gaya ghats, probably extending into the Monghyr Hills! Fl. with the very young leaves, Mar.–May. Fr. Dec.–Jan.

Bark light grey. Blaze green, then white with copious latex. Leaves not shining, glabrous in the type (*F.B.I.*, but always softly pubescent or even velvety in our area, pale beneath and rather a pale green above, those at base of shoots often only 2·5″ long, young leaves dry more or less blue with reddish nerves, sec. n. 7–9 more rarely up to 12 prominent and softly pubescent beneath, whitish. Petiole hardly any ·15″ long. Cymes pubescent with small linear bracts. Follicles about ·25″ diam.

2. **W. tomentosa,** *Roem.* Tuar, *K.* (the word merely means milk, and is applied to other trees with milky sap); Khirna, Kherua, *Kharw.*; Dudh Koraiya (Monghyr), Khiri, *Th.*; Phaokurni, *Or.*

A small tree with slender pubescent branches and distichous

elliptic shortly caudate acuminate (or with a short obtuse acumination) tomentose leaves 2–4″ long, rarely attaining 6″ by 3·5″, and easily distinguished from the last by the 8–14 close strong sec. n. only ·1–·3″ apart and petioles ·2–·3″ long with the milky juice yellow or yellowish-white. Flowers 1″ diam. greenish-orange or cream-coloured with deep-orange or red toothed coronal scales. Follicles 6–12″ connate into a compressed grooved pendant cylinder, greenish, verrucose with white tubercles.

In valleys and damper places than the last but sometimes in association in rocky valleys. Much more widely distributed throughout the whole province in favourable situations, but nowhere very common! Fl. April–July. Fr. Dec.–Feb. Deciduous Feb.–March.

Bark light grey rough with lenticels only, blaze soft, first with a thin chlorophyll layer, then nearly white or a pale greenish brown, with copious latex. The leaves (as in others of the genus, but more markedly) are arranged like the leaflets of a pinnate leaf and far more numerous on the twigs than in *W. tinctoria*, rarely obovate but base often somewhat cuneate. Seeds slender with white coma.

"The wood is used for turning and carved work. Weight about 40 lbs." *Gamble.* The pod-like fruits make the tree easily recognisable.

13. STROPHANTHUS, *DC.*

Small trees or shrubs, without milky juice in some species, climbing in our area, with opposite leaves and large or m.s. flowers in terminal cymes. Calyx glandular within. Corolla with tubular base, then campanulate with 5 lobes remarkable by being produced into sometimes very long tails, throat with 10 scales sometimes connate. Stamens at the top of the tube, included, anthers sagittate, tips filiform adhering to the stigma, base spurred. Disc 0. Carpels distinct, many-ovuled, style filiform, rugose with cellular papillæ, tip dilated, stigma simple or 2-fid. Follicles oblong or elongate free, usually spreading. Seeds compressed, fusiform, narrowed into a feathery tail or with a sessile coma; base with a deciduous tuft of hairs.

1. S. Wallichii, *A.DC.*

A climber with lenticellate branches, oblong cuspidate or shortly caudate glabrous leaves 3–4″ long with minute subulate stipules (?) and intrapetiolar glands and terminal 2-chotomous cymes of pale-coloured flowers veined purple within, easily recognised by the long twisted caudate petals often 2″ long. Follicles 6–8″ long, ·75″ broad at base and 1·75″ broad above base, then tapering to the tip, divaricate in a straight line.

Singbhum forests, in valleys! Mals of Orissa, frequent! Fl. April–May. Fr. c.s. but remaining open until next flowering.

L. usually about 4″ by 2″ with 6–10 fine sec. n. reticulate within the margin. Petiole ·12–·25″. Cymes 3–4′, lax, with recurved linear bracts at the forks. Sepals linear-subulate ·5″, nearly free. Corolla-tube constricted about the middle, ·75″ long, throat with 5 deeply 2-fid scales. Follicles woody pustulate on woody peduncles.

14. PARSONSIA, *Br.*

Twining shrubs. Juice scarcely milky in our species. Leaves opposite. Fls. small white or greenish in 2–3-chotomous, often dense, cymes. Calyx 5-partite, glandular or with 5 scales within or naked.

Corolla salver-shaped with short cylindric or globose tube and naked throat, lobes overlapping to the right. Filaments often twisted, anthers half exsert, acute, conniving over and adhering to the stigma, cells spurred and empty at base. Disc of 5 lobes or scales. Carpels connate, style-top dilated, truncate, stigma columnar or elongate conical, ovules many. Fruit of 2 connate follicles tardily separating when quite ripe. Seeds linear or oblong, tip narrowed and penicillate, albumen scanty, cotyledons linear-oblong, flat.

1. **P. spiralis,** *Wall.*

A twiner with elliptic or oblong-lanceolate glabrous leaves 2–5″ long and greenish flowers in lateral rather close corymbose cymes 2–3·5″ diam. Fruiting carpels forming a grooved poniard-shaped follicle 5–6″ long and ·5″ diam. at base.

Mahanadi delta, Cuttack! Fl., Fr. practically all the year. Evergreen.

Leaves with cuneate to rounded or sub-cordate base, shortly acuminate, sec. n. 4–6 rather fine looping within the margin, petiole ·5–·8″, interpetiolar glands on the stipular line subulate. Cymes including the stout peduncle about as long as broad. Calyx ·15″, sepals ovate thick. Corolla-tube exceeding the calyx, petals erecto-patent ·17″ linear lanceolate or linear-oblong. Anther sagittate lanceolate ·15″ long. Seed ·75″ glabrous.

The plant much resembles an Asclepiad in fruit.

15. VALLARIS, *Burm.*

Twining shrubs with opposite, pellucid, punctulate leaves and white mod.-sized flowers in lateral or subterminal cymes or fascicles. Calyx 5-partite, glandular or not within, sepals narrow. Corolla salver-shaped with short tube and naked throat, petals broad, overlapping to right. Stamens at top of tube with exserted anthers adhering to the stigma, cells with rigid basal spurs, connective with a large dorsal gland. Disc various. Carpels connate, many-ovuled, style pubescent, obscurely annulate at top, stigma thick conical. Fruit of 2 connate follicles tardily dehiscent when ripe ("at length separating," *F.B.I.*, but I have never seen them separate). Seeds 2-seriate, ovate, acuminate or beaked, compressed, tip comose, albumen scanty. Cotyledons flat, thin.

1. **V. Heynei,** *Spreng.* Adaka red, Adatta red, Kukur-botur, *K.*

Stems light grey cord-like tough lenticellate. Leaves oblong elliptic acuminate, nearly glabrous, 1·5″ by ·6″ to 4″ by 1·5″. Cymes of white flowers, pretty, usually subcorymbose, 2–3″ diam. Sepals lanceolate ·17″ Corolla ·5–·8″ diam. with tube only ·1″ long, and broad rounded petals. Disc fleshy, annular. Fruit 6″ by 1·5″ diam., terete, subtruncate at the base, tapering above the middle to a blunt apex.

N. Champaran! Chota Nagpur, valleys in Hazaribagh and Singbhum! Palamau, *Wood*! Gangpur! Mayurbhanj, in valleys! Fl. April-May. Fr. Nov.-Jan. New leaves in March of a light bright green.

L. rather membranous with 5–9 arching fine but distinct sec. n., base acute or obtuse somewhat decurrent on the ·3–·5″ petiole.

Bark very bitter and astringent, chewed by the Kols for fixing loose teeth. "When suspended from the roof on a certain day in June it is believed to keep away snakes during the rains." *Rev. Thompson.*

16. BEAUMONTIA, *Wall.*

Very large climbing shrubs with opposite leaves with strong arched sec. nerves, and very large white flowers in terminal cymes with leafy bracts. Corolla with a very short tubular base, then campanulate with broad lobes. Stamens low down, anthers horny sagittate, adhering to stigma, spurred at base. Disc deeply 5-lobed. Carpels connate. Fruit long, thick, woody, finally dividing into two spreading follicles.

1. **B. grandiflora,** *Wall.*

Frequently cultivated in gardens, native of the Eastern lower Himalaya. Fl. r.s. Evergreen.

Stems very thick and woody, shoots rusty pubescent. L. usually elliptic-oblong or obovate-oblong, abruptly acuminate, about 5–8″ long only in our area, much larger in its wild state. Corolla 3–5″ long, lobes rounded.

17. CHONEMORPHA, *G. Don.*

Very large climbing shrubs with broad opp. leaves and large white flowers in lax terminal and pseudo-axillary cymes. Calyx with a ring of glands within. Corolla salver-shaped with lowest part of tube very narrow then suddenly widened, throat naked, petals broad, obliquely obcuneate, overlapping to right and twisted to the left. Stamens at the swelling of the tube, fil. short villous, anthers sagittate, elongate, pungent, adhering to stigma, cells spurred. Disc thick, annular or cupular. Carpels distinct, top of style globose, stigma conoid or subclavate. Follicles long, straight, parallel, 3-gonous. Seeds ovoid or oblong, flat, shortly beaked, coma long, albumen thin. Cotyledons oblong, flat.

1. **C. macrophylla,** *G. Don.* Barkla dudhia, *Th.*

A powerful climber with thick brown lenticellate branches marked with opposite leaf scars, younger strigillose. Leaves very large, 8–16″, elliptic, ovate, obovate or orbicular, cuspidate, with 7–12 strong sec. n. and well-marked cross nervules. Flowers 2·5–3″ diam. in axillary and terminal peduncled narrow cymes with opposite ovate deciduous bracts. Follicles 8–15″ by ·75″.

Ravines of the Ramnagar Hills! Fl. May–July. Fr. Jan. It is often also found in gardens.

Juice very milky. Young leaf-buds densely yellow-tomentose, mature leaves softly pubescent beneath. Petiole 1–1·75″ stout. Stipular line with glandular teeth. Calyx ·3–·5″ with lanceolate sepals. Petals obovate ·7–1″ wide.

18. AGANOSMA, *G. Don.*

Stout climbers, juice not or slightly milky, with opp. leaves and m.s. or large flowers in terminal tomentose cymes. Sepals narrowly lanceolate acuminate, rarely oblong-ovate, with subulate glands at the base. Corolla salver-shaped with short basal narrow tubular portion, then suddenly tube wider* with bearded longitudinal bands behind the anthers, petals overlapping to the right and scarcely twisted in bud. Stamens at the base of the broader tube, anthers

* *Sir J. D. Hooker*, in this and similar cases, calls the wider tubular portion a "long throat."

sagittate, rigid, adnate to stigma, spurred at base. Disc cupular, 5-lobed. Carpels distinct, many-ovuled. Top of short style urn-shaped, stigma columnar. Follicles terete, straight or curved and sometimes cohering at the tip. Seeds ovate or linear-oblong, flattened, glabrous. Cotyledons oblong.

1. **A. caryophyllata,** *G. Don.* Raten, *S.*; Malati, *Or.*

A large and beautiful climber with ovate or elliptic acute, obtuse, or shortly acuminate leaves 3–5·5″ by 1·5–3″ and lax pubescent corymbose cymes 6–8″ diam. of large white flowers 1·5″ diam. Sepals linear spreading 1–1·2″. Corolla narrowly tubular for ·2″, then more widely tubular and fluted for ·3″, petals spreading, somewhat obliquely ovate acuminate, tip not or only slightly spiral, twisted in bud. Follicles densely yellow-tomentose when young, spreading or recurved or cornute and cohering by their tips, very variable in size, 4–14″ long and ·3–·7″ diam. tapering gradually to the tip.

Monghyr, *Ham.*; Manbhum, *Campbell*! Rocky ravines in the Santal Parg.! Baruni Hill, Khurda, etc. Puri! Rocky valleys in Angul and Daspalla! Often, cultivated. Fl. August. Fr. Feb.–April.

Stems grey shining pustulate and thinly strigose. Young shoots densely tomentosely hairy. L. glabrous or tomentose beneath, base rounded, sec. n. 2–5 usually red in colour, very oblique, minutely reticulate between, petiole ·25–·75″, leaves of a pair sometimes unequal, petiole ·25–·75″. Sepals sometimes only ·6″, tomentose. Disc large, concealing the ovary. Seeds flat ·6–1″ long with a coma rather longer.

19. ANODENDRON, *A.DC.*

Climbing shrubs with opp. leaves with rather distant nerves, juice not or only slightly milky (in our species). Flowers small in axillary and terminal wide spreading panicled cymes. Calyx with obtuse sepals eglandular within. Corolla salver-shaped with contracted mouth, petals narrow, overlapping to the right, twisted to the left. Stamens below middle of tube, anthers sagittate, adherent to stigma, shortly spurred at base. Disc cupular. Carpels distinct, sunk in the disc and adherent to it dorsally at their base. Style very short, top cupular, stigma thick conic. Follicles diverging acuminate, hard.

1. **A. paniculatum,** *A.DC.*

A very large climber with stout grey-black or green perfectly smooth and cylindrical stems up to 3″ diam. Leaves coriaceous, oblong or somewhat wider upwards and shortly suddenly acuminate, lower large 7–8″ by 4–5″, sec. n. strong nearly straight, 12–15. Fls. small pale yellow ·3″ diam. with linear petals, villous in large lax 3-chotomous axillary and terminal brachiate panicles. Follicles spreading 5–6″ by ·75″ at the rounded base, woody, poniard-shaped.

Rather rare. Along streams in evergreen forest. Singbhum, rare! Mals of Orissa! Fls. March–April and fruits ripen about a year after.

Blaze white with brown patches exuding a copious flow of brown coloured sap, not at all milky. Upper leaves 4–5″ by 1·5″ narrow-oblong cuspidate. Panicles 3–6″. Seeds brown ellipsoid thin concave pointed at one end, ·7″ long and ending in a large coma 2″ long.

N.B.—According to a note by *Lister* on a Chittagong specimen the juice is sometimes milky. It is said sometimes to produce rubber.

20. ICHNOCARPUS, *Br.*

Climbing shrubs with small or minute flowers in long terminal and axillary paniculate cymes. Calyx 5-fid, glandular or not within. Corolla salver-shaped, throat contracted or villous, petals narrowed to an obtuse often twisted tip, upper half deflexed in bud. Stamens at or below the middle of the tube, anthers sagittate, adhering to stigma, spurred at base. Disc free, 5-lobed. Carpels distinct, hairy, exserted from disc, style short, top obconic, stigma columnar. Follicles spreading or divaricate, slender and subterete or rigid and compressed. Seeds narrowed at the tip with deciduous coma, albumen copious, cotyledons long flat.

Corolla-tube glabrous,* mouth villous . . . . . 1. *frutescens.*
Corolla-tube pubescent, mouth puberulous . . . . . 2. *ovatifolius.*

1. **I. frutescens,** *R.Br.* Onol-sing, *K.*; Dudhi-lota, *S.*; Saon-lar, *Kharw.*; Taparlohar, Soyam-noi, *Or.*

A large rambling shrub woody below with rusty-tomentose branches, elliptic or broadly-oblong acute or shortly acuminate glabrous leaves 1·5–4·5″ by 1–2″ and narrow panicles of small white flowers ·3″ diam. with narrow twisted bearded lobes.

Common, especially in hedges in moist localities, in all districts! Purneah, very common! Fl. Sept.–Dec. Fr. Jan.–April. The leaves turn brown or reddish in Feb. before falling.

L. pale and finely reticulate beneath, base rounded or acute, sec. n. about 5. Petiole ·17–·25″. Panicles usually leafy with short branches, pedicels ·05–·2″ only. Calyx with linear glands within, sepals ·07″, corolla-tube swollen in the middle, ·12″, usually pubescent, mouth villous. Follicles 3–6·5″ linear divaricate slightly flattened, ·1″ broad, densely red tomentose when young with a brownish thin tomentum when mature. Seed about ·5″ brown linear grooved with a coma about ·25″.

The plant is much used for tying. The properties of the roots are said to be the same as those of *Hemidesmus indicus* but the plant is often confused with that and the roots lack the sweet aromatic perfume of the *Hemidesmus*.

2. **I. ovatifolius,** *A.DC.*

This is said to occur in Chota Nagpur (*Bengal Plants*), the distinguishing characters being those given in the key above, but as the tube of *I. frutescens* is *nearly always pubescent* or silky and *De Candolle* himself states that the flowers only differ in the slightly broader calyx lobes the distinction hardly seems adequate. *De Candolle* gives as the chief character of *ovatifolius* the ovate acuminate leaves with very obtuse base, whereas those of *I. frutescens*, according to his diagnosis, are elliptic and acute both ends. Such *ovate* leaves occur in plants in our area but these do not seem specifically different.

FAM. 90. ASCLEPIADACEÆ.

Herbs or shrubs, usually twining and nearly always with milky juice, closely allied to the Apocynaceæ and differing chiefly in the androecium. Leaves opposite, sometimes undeveloped, very rarely alternate, quite entire, exstipulate, but often with stipular lines and intrapetiolar or interpetiolar glands. Flowers regular, 2-sexual, 5-merous, usually in axillary umbelliform cymes. Calyx-lobes im-

* But see remarks under both species.

bricate. Corolla-lobes valvate or overlapping to the right, very rarely to the left, tube or throat often with a corona of scales, processes or hairs (*corolline corona*). Stamens at the base of the corolla, sometimes free, but more usually connate into a fleshy column investing the pistil except the top of the stigma and usually bearing dorsal processes collectively termed the *staminal corona*; anthers at the top of the column, connate or free, adnate to the stigma and the tip often produced into a membrane appressed to or inflexed over the stigma; the pollen forms 1 or 2 masses (*pollinia*) in each anther cell, and these pollinia are united to a minute *corpuscle* between the anthers in such a way that the pollinium or pollinia of the left-hand lobe of one anther is connected to the same corpuscle as the pollinium or pollinia of the right-hand lobe of the next anther*; the corpuscle is attached to the swollen top of the style or side of the stigma. Carpels 2 distinct, styles 2 short, united in the large stigma,† which is usually 5-angled and included between the anthers or produced beyond them into a simple or 2-fid column. Fruit of 2 (–1) follicles. Seeds compressed, usually flat margined or winged and with a coma (exc. *Sarcolobus*). Albumen copious. Embryo large, cotyledons flat, radicle short inferior.

I. Filaments free. Pollinia granular, 2 in each cell (Periploceæ) :—
  A. Corona coralline. Twiners :—
    Corolla very small, rotate, purple, lobes valvate . . 1. *Hemidesmus.*
    Corolla small or m.s., rotate, greenish, lobes overlapping 2. *Cryptolepsis.*
    Corolla large, subcampanulate, purple . . . . 3. *Cryptostegia.*
  B. Corona staminal. Prostrate herb (in our species) . . 4. *Streptocaulon.*
II. Filaments connate into a tube. Pollinia waxy, 1 in each cell :—
  A. Anthers with a membranous tip. Pollinia often pedicelled (Euasclepiadeæ) :—
    1. Pollinia pendulous from the corpuscle :—
      a. Erect, leafy :—
        Coronal processes spreading fleshy sculptured . 5. *Calotropis.*
        Coronal processes erect spathulate . . . . 6. *Asclepias.*
      b. Twiners, or suberect (12), or erect and leafless (13) :—
        i. Corona double. Flowers large or m.s.‡ :—
          L. narrow, deciduous. Corolla large. Follicles smooth . . . . . 7. *Oxystelma.*
          L. broad. Inner corona with long appendages. Follicles echinate . . . . . 8. *Pergularia.*
        ii. Corona single staminal, processes discrete :—
          Corolla campanulate, large, white . . . 9. *Raphistemma.*
          Corolla rotate, small, purplish . . . . 10. *Pentatropis.*
        iii. Corona single staminal, processes united into a lobed or toothed ring or cup :—
          * Leafy twiners (or sub-erect in *Cynanchum*) :—
            Flowers large. Corona with 5 horny processes. Follicles terete . . . . . 11. *Holostemma.*
            Flowers small. Follicles keeled or winged . 12. *Cynanchum.*
          ** Erect or straggling leafless shrubs, branches fleshy . . . . . 13. *Sarcostemma.*

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* By removing carefully the usually hard dark-coloured corpuscle the pollinia can usually be withdrawn from the anther cell on either side.

† The enlarged portion is probably the swollen top of the combined styles, for brevity referred to as the stigma. The stigma proper is on the top and centre of this swelling.

‡ See also note under "11. *Holostemma*," p. 554.

2. Pollinia erect on the corpuscle (rarely horizontal or pendulous in 19. *Tylophora*):—
   a. Corolla lobes overlapping (all twiners exc. *Tylophora spp.*):—
      i. Corona 0. Flowers small, crowded . . . 14. *Sarcolobus*.
      ii. Corona coralline, of pubescent ridges. Fls. small 15. *Gymnema*.
      iii. Corona staminal (corolla sometimes also villous):—
         * Corolla salver-shaped. Fls. m.s. Coronal processes erect . . . . . 16. *Telosma*.
         ** Corolla campanulate. Fls. rather small. Corona appressed to column, with membranous tips . 17. *Marsdenia*.
         *** Corolla rotate:—
            Fls. m.s. Coronal processes stellately spreading, fleshy, with small inner cusp. Pollinia oblong . . . . . 18. *Dregea*.
            Fls. very small. Coronal processes rounded or depressed. Pollinia globose . . . . 19. *Tylophora*.
   b. Corolla valvate. Corona stellately spreading:—
      Climbing or epiphytic with fleshy leaves and waxy fls. . . . . 20. *Hoya*.

B. Anthers without a membranous tip. Pollinia sessile or subsessile, erect or horizontal. Corolla valvate (Ceropegieæ):—
   1. Corona double. Flowers small . . . . . 21. *Leptadenia*.
   2. Corona single, staminal:—
      Twining. Petals appendaged, often cohering at tip 22. *Ceropegia*.
      Erect, fleshy, with 4-angled leafless stems. Fls. large . . . . . 23. *Boucerosia*.

1. HEMIDESMUS, *Br.*

Twining suffruticose herbs or shrubs. Fls. small, greenish purple, in dense subsessile cymes. Sepals glandular within. Corolla rotate with thick valvate lobes. Corona corolline, of 5 scales on the throat alternate with the lobes. Filaments distinct, anther-tips connate inflexed membranous, pollinia granular, 2 in each cell attached to corpuscle by dilated appendages. Stigma with flat crown, 5-angled. Follicles long slender, terete, divaricate or reflexed.

1. H. indicus, *Br.* Anandamal, *H., Beng.*; Kapri (Sambalpur).

A slender twining shrub with an aromatic rootstock, rather distant pairs of leaves, 1–4″ by ·3–1·5″, most variable in shape but always apiculate, pale beneath and very frequently with a white streak above, base rounded and few sec. n. The small flowers ·2″–·25″ diam. are clustered in the leaf-axils and are green outside but purple within. Follicles spreading in fruit 4–5″ by ·2″ diam.

Under shade and mostly in moist localities, distributed throughout the area, sometimes common! Fl. Aug.–Sept. Fr. Oct.–Dec. Evergreen.

Glabrous or (var. *pubescens*) pubescent. Leaves linear to broadly elliptic rarely obovate or lanceolate, sec. n. 5–6 but intermediate often nearly as strong and rather irregular, looping and very reticulate between. Petiole ·15–·25″. Cymes with numerous small ovate acute bracts on branches and pedicels. Sepals spreading and calyx sometimes ·25″ diam. in fruit. Petals rather fleshy and coronal scales usually mere small fleshy knobs. The corpuscle is prominent as a small white tongue to which the two pairs of pollinia are attached; they are dragged out of the anther by the growth of the filaments and ultimately lie naked.

The rootstocks which are about ·2–·3″ diam. with brown skins but white within are easily distinguished from those of *Ichnocarpus* by their sweet smell. They are in high repute for fever and skin diseases.

2. CRYPTOLEPIS, *Br.*

Twining shrubs. Flowers small or mod.-sized in lax terminal or axillary cymes. Calyx with 5 scales within. Corolla with short cylindric or campanulate tube and narrow lobes overlapping and twisted to the right. Corona corolline, of 5 linear or clavate conniving scales at about the middle of the tube. Filaments subconnate at their broad bases, anthers with conniving acuminate tips, pollinia cohering in pairs in each cell, granular with oblong appendages. Stigma broadly conic. Follicles divaricate, terete.

Corolla ·7″ diam., sepals acute. Follicles 2–4″ . . . . . 1. *Buchanani.*
Corolla 1–1·5″ diam. Sepals obtuse. Follicles 5–8″ . . . . 2. *elegans.*

1. C. Buchanani, *Rœm.* Utri dudhi, *S.*; Dudhla lar, *Kharw.*; Karanta, *H.*; Gar, *Or.*

A large twining shrub with glabrous oblong or elliptic leaves shining above and very pale-glaucous beneath, 3·5″ long, 1·5–2·5″ wide, with very numerous slender nearly horizontal sec. n. united within the margin. Flowers pale yellow about ·7″ diam. in lax often panicled cymes with opposite divaricate fleshy branches constricted at the nodes. Sepals ovate acute ·1″. Follicles poniard-shaped 2·5–4″ long, ·5–·75″ diam. in middle.

Common throughout the area. Fl. May–June. Fr. Dec.–Feb. Evergreen.

Bark brown in old stems peeling off in large very thin strips. Milky juice very copious. L. rarely up to 6″ long, base and tip rounded or base subacute and tip cuspidate, nervules reticulate. Petioles ·3–·6″. Cymes usually 1–2″ long and broad, pedicels ·12″. Cor.-tube ·1–·12″, lobes ·3″ linear-lanceolate. Coronal scales clavate fleshy. Pollinia very minute, linear.

Campbell says that the milk is given to nursing mothers. This is apparently suggested to the Santals by the milky juice, species of *Euphorbia* being similarly used.

2. C. elegans, *Wall.*

Leaves smaller than in the last, 2·5–3·5″ with rounded apex tipped by a small cusp, sec. n. not very close nor as parallel as in *C. Buchanani.* Petioles very slender ·2–·5″ long. Cymes with long peduncles and two long slender branches, few-flowered, pedicels slender. Flowers "yellow 1–1·5″ diam.," *F.B.I.* Sep. ovate obtuse. Follicles slender 5–8″ long, divaricate.

Orissa, *Heyne* (but possibly in Madras). Angul, *B. K. Chattarjee*! In young fruit in November.

3. CRYPTOSTEGIA, *Br.*

Large climbers with large flowers in terminal 3-chotomous cymes. Sepals lanceolate. Corolla campanulate with a short basal tubular portion, lobes broad, overlapping and twisted to the right. Corona corolline at base of the throat, subulate, entire or 2-cleft. Anthers acute, pollinia 2 in each cell, granular with subspathulate appendages. Stigma convex. Follicles thick, divaricate, hard, 3-winged.

1. C. grandiflora, *Br.*

A scrambling glabrous shrub with elliptic obtuse coriaceous shining leaves 3–4″ long and large, light purple flowers 1·5–2″ diam.

Rather frequent in gardens. Fl., h.s. and r.s. Native of Africa.

4. STREPTOCAULON, *W. & A.*

Twining or prostrate. Flowers small or minute in 3-chotomous, sometimes panicled cymes. Corolla rotate. Stamens free except at the tips of the anthers which have inflexed membranous appendages and connive over the stigma, pollinia 2 in each cell, granular; interposed teeth or glands between the filaments. Corona at the base of and adnate to the backs of the filaments, of linear or filiform scales. Follicles terete, divaricate.

1. **S. sylvestre,** *Wight.*

A trailing herb with elliptic orbicular-ovate or orbicular, sub-sessile, leaves 1–1·5″ long which lie closely adpressed to the soil, and pretty little purple flowers ·3–·35″ diam. in small very shortly peduncled pubescent axillary cymes. Follicles not seen.

Sandy steep banks of rivers. Purneah! Fl. April–May and also December.

Branches 12–18″ long from a woody rootstock, somewhat pubescent. Juice viscid milky. L. pubescent or tomentose beneath, base rounded or cordate, sec. n. 5–7 of which 1–2 near the base, rather strong beneath. Calyx ·05″, lobes ovate. Petals oblong. Coronal scales linear, white, with filiform tips.

This is rather a rare plant, only previously collected apparently by *Hamilton* and *Clarke*, neither of whose specimens nor mine own show fruit. The plant must not be confused with *Tylophora rotundifolia*, which has a similar habit and also has orbicular very shortly-petioled leaves.

5. CALOTROPIS, *Br.* Swallow-wort.

Shrubs or undershrubs or stout herbs, rarely sub-arboreous, not climbing. Leaves broad subsessile or short-petioled. Flowers large or m.s. in umbelliform or subracemose cymes. Sepals glandular within. Corolla broadly campanulate or subrotate with broad valvate lobes. Corolline corona 0. Staminal corona of 5 fleshy laterally compressed sculptured processes radiating from the staminal column. Anther-tips membranous inflexed, pollinia 1 in each cell, waxy, flattened, pendulous (on a lower level than the corpuscle) attached to the corpuscle by pedicels. Stigma depressed, 5-angled or -lobed. Follicles short thick.

Shrubs. Leaves subsessile:—
Corolla uniformly coloured, lobes spreading . . . . . 1. *gigantea.*
Corolla white with purple blotch on the *erect* lobes . . . . 2. *procera.*
Herbaceous. Petiole sometimes attaining 1″:—
Corolla-lobes erect . . . . . 3. *acia.*

1. **C. gigantea,** *Br.* Syn. Asclepias gigantea, *Willd.*; Palati, palti, *K., Uran*; Akaona, *S.*; Akaon, *Kharw.*; Akanda, *Beng.*; Madar, Akona, *H.*

A stout hoary-tomentose shrub, or occasionally a small tree with trunk 12″ girth. L. large more or less obovate-oblong 4–8″ long with a cordate, often amplexicaul base. Flowers handsome reddish light-purple or lilac or nearly blue, 1·5–2″ diam., with spreading ovate-lanceolate petals. Follicles 3–4″ long and 1·5″ thick, recurved, obtuse.

Frequent in open waste ground and sometimes sub-gregarious (as on islands in the Mahanadi near Narsingpur), throughout the area. Fl. Dec.-July. Fr. Feb.-June. Evergreen.

Branches and leaves beneath felted white-tomentose. Calyx-lobes short spreading. Corolla-lobes revolute and twisted when old. Coronal processes with their

bases elegantly curved, dorsally pubescent, their apices with two little spurs or tubercles. Top of column 5-angled, corpuscle small black at the angles.

Yields the well-known *Madar* fibre derived from the bast. The floss (coma of the seeds) is also sometimes spun but is used more for stuffing like other silk-cottons. It was at one time experimentally cultivated in Chota Nagpur (*Watt, D.E.P.*, ii, p. 42). Various medicinal virtues are ascribed to the juice. The Kols use it as a drastic purgative and fever medicine, but they prefer the *Euphorbia*. The Santals "give a decoction of the root in infantile convulsions and delirium during fever," *Campbell*. Mahouts use the leaves as warm fomentations in treating abscesses on elephants. *Nadkarni* says that the root-bark and inspissated juice are alterative, tonic, diaphoretic and in large doses emetic, and gives other uses in various diseases.

2. **C. procera,** *Br.* Vern. names as in last.

A shrub much resembling the last but not usually over 4 ft. high. L. oblong cordate, usually suddenly often sharply acute or sub-mucronate, old glabrous both sides. Peduncles often paired in the axils, 1–3″ long, tomentose, often branched. Fls. about ·5″ diam. having the lobes erect ·5″ long acute, white with purple blotch on the upper half. Coronal processes with a purple obtuse muticous tip and fleshy upturned white base. Ripe follicles 3″ by 1·5″, (4–5″, *F.B.I.*) recurved somewhat sausage-shaped, outer and inner coats (as in the last) with fibrous tissue between. Seeds obovate ·25″.

Generally distributed, in similar places to the last, but less common. Fl., Fr. most of the year.

The uses are apparently the same as it is often confounded with the last. (As regards its fibre see *Ind. For.*, Sept., 1897, p. 341.) I understand that the juice of these plants is not taken internally by the Urans for fever, and one sometimes sees Urans with large scars over the side due to the external application of the leaves for fever and spleen. They are said to produce large blisters.

3. **C. acia,** *Hamilt.*

A stout herb or undershrub 2–3 ft. high with glabrous oblong, obovate or oblanceolate leaves 6–8″ long, narrowed into a petiole ·3–1″ long. The flowers are much as in *C. procera*, coronal processes 2-lobed.

In forest and grass lands. Bettiah ! Northern Purneah ! Fl., Fr. April-June.

6. ASCLEPIAS, *L.*

Erect herbs with opposite, alternate or whorled leaves and small or mod.-sized flowers in umbelliform cymes. Sep. glandular within. Corolla rotate, lobes often reflexed, valvate. Corona staminal of 5 erect spoon-shaped processes, anther-tips inflexed, membranous, pollinia 1 in each cell, waxy, pendulous, flattened. Stigma depressed, 5-angled. Follicles turgid, beaked.

1. **A. curassavica,** *L.* Blood flower.

About 2 ft. high with lanceolate or oblong-lanceolate glabrous or somewhat pubescent leaves 2–3″ long and many-flowered umbels of orange or scarlet moderate-sized flowers with reflexed corolla and 5 erect spoon-shaped coronal processes adnate to the stipitate column. Follicles inflated.

Native of the West Indies. Often found in gardens and villages and very pretty when in flower.

7. OXYSTELMA, *Br.*

Twining herbs or undershrubs with narrow leaves, sometimes deciduous. Fls. large in lax umbelliform cymes with filiform pedicels.

Corona double, *corolline* annular papillose or villous within and with membranous margin, *staminal* of 5 scales with cordate or dilated bases and 2-keeled within. Anthers with membranous inflexed tip. Pollinia 1 in each cell pendulous oblong compressed. Follicles thick oblique or curved.

1. **O. esculentum**, *Br.*

A pretty slender twiner with linear or narrow-lanceolate finely acuminate leaves 3–5″ long with many sec. nerves looping within the margin. Fls. 1″ diam., corolla white or pink, veined with purple, margins densely villous. Follicles oblong 1·5–2″ long.

Along the Nepal frontier. Purneah, *Kurz*! Along the Ganges, above Patna. Fl. July–Sept. Fr. Nov. Perennial, deciduous.

8. PERGULARIA, *L.*

(*Vide N. E. Brown* in *Kew Bulletin*, 1907, p. 323.)

Twining, more or less hairy or tomentose, herbs or shrubs with cordate leaves and greenish white or yellowish, salver-shaped, short-tubed, flowers in racemiform or corymbiform cymes with filiform pedicels. Sep. glandular within. Corolla-lobes broad, overlapping to right. Corona double, corolline at base of staminal tube, annular, 5–10-lobed or -crenate, staminal of 5 laterally compressed processes adnate to the anthers and meeting over the top of the stigma, prominently spurred behind towards base. Anther with membranous inflexed tip. Pollinia 1 in each cell sub-compressed, pendulous waxy. Follicles echinate.

1. **P. extensa,** *N. E. Br.* Syn. Dæmia extensa, *Br.*; Mosiphul, *Kharw.*; Chagul-bati, *Beng.*; Uturdi, *Or.*

A slender subhispidly hairy or glabrate fœtid climber with membranous orbicular or broadly ovate, deeply cordate, acuminate leaves 2–4″ long and broad, and green, or yellowish-green, and red flowers ·6–·7″ diam (with white corona) in long-stalked, sometimes panicled, drooping corymbs. Follicles 1·5–2″, lanceolar with long soft spines.

Palamau, in village hedges! Puri, ditto! Angul, very common, in hedges, and also occurs in the forests about Antulia and Baghmunda! Fl. Oct.–Dec. Fr. Dec.–Jan.

L. pubescent beneath, apex sometimes caudate, basal lobes rounded incurved sinus very broad. Petiole about as long as leaf. Peduncles 2-6″, pedicels ·5–2″. Sepals short erect ·12″ with 2 small glands within, pubescent. Cor.-tube slightly exceeding sepals, lobes spreading densely villous-ciliate, linear- or ovate-oblong with reflexed margins. Corolline corona slightly exceeding tube with 5 oblong truncate petaloid lobes and small inflexed intermediate lobes. Pollinia clavate compressed.

The flowers and leaves are eaten in Palamau.

9. RAPHISTEMMA, *Wall.*

Twining shrubs with large white flowers in long-peduncled umbelliform cymes. Calyx 5-glandular within. Corolla with campanulate tube and oblique or spreading lobes, twisted in bud and overlapping to the right. Staminal corona of 5 scales which are produced into long slender linear tails meeting over the column. Column large, anthers with an inflexed membranous tip, pollinia 1 in each cell, not

compressed, pendulous, waxy. Stigma flat 2-lobed. Follicles thick, acute.

NOTE.—The coronal scales are described as membranous in the *F.B.I.* They are so in the herbarium, but in our species at least they are thick and fleshy in a state of nature.

1. **R. pulchellum,** *Wall.*

Rather a large twiner with ovate cordate leaves 4–9″ long and handsome pure white rather fleshy campanulate flowers 1–1·5″ long and broad, in few-fld. cymes. Pedicels 1–1·3″. Follicles 6″ by 1·5″, fusiform (*fide F.B.I.*).

Evergreen forest near streams in deep valleys, Singbhum! Fl. Aug.–Sept.

L. very membranous when dry, glabrous or puberulous beneath with 5–7 strong primary nerves and a wide basal sinus, around which the basal auricles sometimes incurve, tip usually cuspidate, base of midrib glandular, sec. n. of mid-rib 3–5, tertiaries not reticulate. Petiole 2–5″. Stipular lines with stout glands. Sepals elliptic rounded ·2–·25″ (very variable in size, *F.B.I.*). Corolla lobes obliquely spreading oblong.

Hooker describes the follicles from a drawing as "solitary (?) sharply deflexed from the very base, slightly upcurved, green." I have not seen them.

10. PENTATROPIS, *Br.*

Twiners with small leaves and small purplish flowers in axillary sub-umbelliform cymes or racemes with filiform pedicels. Corolla rotate, petals twisted to the left and slightly overlapping to the right. Corona staminal, of laterally compressed radiating fleshy laminæ spurred at the base and with a free apex. Anthers with a small membranous inflexed tip. Pollinia rounded. Follicles fusiform.

1. **P. microphylla,** *W. & A.*

A slender twiner with glabrous stems and glabrous oblong apiculate leaves ·5–1·5″ long with rounded or cordate base and petioles ·1–·15″ long. Fls. about ·4″ diam. on slender pedicels ·25–·5″ long arising from a short rhachis scaly with small lanceolate bracts. Follicles 1·5–2″ long on firm pedicels ·6–·8″ long. acuminate.

Mahanadi delta! Fl. March–June. Fr. Aug.–Sept.

L. with 2–3 indistinct sec. n. Sep. ovate-lanceolate ·07″, petals broadly lanceolate ·15–·2″ minutely pubescent on the face, very acute.

It sometimes resembles *Hemidesmus indicus.*

11. HOLOSTEMMA, *Br.*

Twining shrubs with cordate leaves, membranous when dry. Flowers large, purple inside, in axillary few-fld cymes. Sepals eglandular. Corolla campanulate or sub-rotate, lobes thick ovate, overlapping to the right. Corona double; outer thick annular fleshy, sometimes 10-lobed partly adnate to base of corolla and of column; inner of 5 horny 2-winged processes at the backs of the anthers, the wings of adjacent anthers sometimes contiguous so that the column appears 5-winged with each wing 2-lamellate. Anther-tips membranous erect obtuse, pollinia 1 in each cell long linear pendulous attached to the black corpuscle (situated at the apex of each pair of wings) by very long black pedicels. Stigma 5-winged. Follicles thick.

Note.—Following the *F.B.I.* I have described the corona as single in the Key, but it appears to me to be more correctly described as double as above. The annular corona is quite free from the column above.

1. **H. Rheedei,** *Wall.* Syn. H. Rheedianum (*Cooke* in *Flora of Bombay*, but in the opinion of *Hook. f.* in *F.B.I.* this must be a different plant); Moron arak', *S.*

A handsome climber with glabrous shining stems. Leaves oblong-ovate 3–7″ long with deep basal sinus, or upper somewhat triangular, tip cuspidate, glabrous above, puberulous or thinly pubescent beneath. Flowers white or pale-pink outside, crimson inside with corolla ·6″ long deeply cleft into ovate acute lobes. Follicles 4″ by 1·3″ pustulate.

Manbhum, *Campbell*! Dalbhum, *Gamble*! Singbhum, in ravines, rare! Fl. July–Sept. Fr. Jan. Also Gorakpur and Sikkim Tarai and therefore probably occurs in Bettiah and Purneah.

The leaves very closely resemble those of *Raphistemma* but are not so large nor relatively so broad, tip with a lanceolate cusp ·25–·3″ long; basal lobes long usually leaving a deep oblong sinus, basal nerves 5–7, sec. n. 2–3 only but intermediate numerous and reticulations stronger than in *Raphistemma*; 5–7 subulate glands at base of midrib above. Petiole 1–1·7″.

Leaves eaten, and a decoction of the root given for cough, *Campbell*.

12. CYNANCHUM, *L.*

Erect or twining herbs or shrubs with opp. rarely whorled leaves and small greenish or purplish flowers in axillary umbelliform racemose or subpaniculate cymes. Corolla rotate, lobes overlapping to the right or valvate. Corona adnate to the base of the column, 5-partite or cupular or campanulate, variously toothed or lobed, with or without scales or tubercles on the inner face opposite to the lobes. Anthers sessile or stipitate with membranous inflexed tip. Pollinia 1 in each cell, pendulous, waxy, not compressed. Follicle terete or sub-alate.

1. **C. ca lialata,** *Ham.*

A twiner with variously shaped leaves, the best characters for which are their rather soft fleshy texture, pale glaucous beneath, glabrous, shallow cordation and apiculate or shortly cuspidate tip, sec. n. 5–8 spreading, looping, obscure. Petioles ·5–1·7″ with swollen bases meeting round the stem. Fls. ·3″ diam. glabrous in shortly peduncled umbels with a short cupular, alternately toothed and crenate, corona. Follicles 2·5–3″ lanceolate acuminate with one side flattened subalate on its edges, the other convex with two ridges.

Purneah! Parasnath, *Anders.*, *Clarke*! Fl. Sept.–Oct. Fr. Nov.–Jan.

Young shoots pubescent. L. 2·7–4·5″ long from linear to broadly elliptic or rotund; my specimens have an emarginate apex with a sharp lanceolate cusp which does not occur in the others. Cymes ·7–1″ with the peduncle, nearly glabrous. Seeds ·3″ with the broad wing, broadly obtusely ovate with a long silky coma, base of wing sometimes crenate.

There are sometimes two small leaflets in the axils of the leaves.

13. SARCOSTEMMA, *Br.*

Shrubs with terete green often jointed branches and very small transient leaves. Flowers rather small, sometimes wax-like, in

umbels from the nodes or terminal. Corolla rotate with broad lobes. Corona cup-shaped adnate to the base of the column, 10-lobed or -crenate, the lobes opposite to the stamens bearing large fleshy processes adnate to the backs of the anthers. Column short. Anther-tip inflexed. Pollinia 1 in each cell, pendulous, slender, waxy.

1. **S. brevistigma,** *Wight.* Kulu-tuar, *K.*

A usually leafless jointed shrub 2–3 ft. high with green straggling branches, or sometimes trailing over bushes and attaining 6 ft. Flowers white waxy fragrant ·4″ diam. very pretty, in umbels at the ends of the branches but not really terminal.

Usually on arid rocks. Ranchi (Horhap forest)! Singbhum! Puri! Fl. Sept.–Jan.

It bears small linear-oblong leaves ·25–·75″ long in the rainy season. Umbels with a hoary curly minute pubescence, usually sessile. Pedicels ·3–·5″. Petals with revolute margins, sometimes creamy-white. Column very short with the inner coronal processes pure white almost concealing the anthers, the column with the processes being flat-topped. Follicles (not seen by me) slightly diverging, thinly coriaceous, narrowed to the base.

The milk is used in the same way as that of *Calotropis*; it is said to be "very powerful" (the name signifies tiger's milk); it is probably a rank poison!

14. SARCOLOBUS, *Br.*

Twiners with small crowded axillary cymose flowers. Corolla campanulate-rotate, petals overlapping to the right. Corona 0. Column very short, anthers marginate with inflexed, not conspicuously membranous tip, between the radiating walls of the column. Pollinia 1 in each cell erect with twisted pedicels. Follicles thick fleshy globose or oblong. Seeds large without a coma.

1. **S. carinatus,** *Wall.*

A small twiner with brown exfoliating bark on the stems. L. rather fleshy, broadly elliptic or oblong or narrowly elliptic on the same branch, pale beneath, with 3–5 sec. n. and green, not raised, reticulations. Flowers ·35″ diam. green or pale yellow with rotate corolla prettily marked with irregular purple radiating lines. Fruit (not seen on my specimens) 3″, curved, beaked, with narrow undulate keels, pale yellow, fleshy.

Mahanadi delta! Fl. April–Aug.

My specimens have leaves only 1″ long narrowed at the base into a ·2″ long petiole; other specimens show leaves up to 2″, and *Griffith* (*Notulæ*, p. 53) says "leaves with subcordate base," but none of the Calcutta Herb. specimens show this. Peduncle very short, pedicels minutely bracteolate at base. Sepals oblong obtuse ·07″. Pet. broadly ovate-oblong rounded. Anthers sessile.

Griffith says that a violent poison is produced from the seed (in Malacca).

2. **S. globosus,** *Wall.*, which is common in the Sunderbans, is also likely to be found in the Mahanadi delta. It has leaves 3–4″ long, anthers shortly stipitate and globose fruits 4″ diam.

15. GYMNEMA, *Br.*

Twining shrubs or suffruticose, with small flowers in umbelliform cymes. Corolla sub-rotate, campanulate or urceolate with thick twisted lobes, subvalvate or narrowly overlapping to the right. Corona 0 or corolline of fleshy processes on the throat produced

downwards on the tube as double villous ridges. Column short, anther tips membranous, pollinia very minute, erect, subsessile on the corpuscle. Stigma large, conical or domed, projecting beyond the anther tips. Follicles slender acuminate.

Coronal processes with fleshy apices protruding above the throat.

Leaves pubescent:—	
Flowers under ·1″ long. L. pubescent	1. *sylvestre.*
Flowers ·12–·13″ long. L. tomentose beneath	2. *hirsutum.*
Throat naked. Leaves glabrous	3. *tingens.*

1. **G. sylvestre,** *Br.* Syn. G. hirsutum, W. & A.? Merasingi, *H.*

A rather slender woody climber with densely, often yellow pubescent or hirsute branchlets, broadly elliptic oblong or ovate often cordate-based leaves 1–2″ rarely 3″ long, more or less pubescent especially on the nerves beneath and usually thinly hairy also above, at least when young. Fls. minute, ·1″ long (when petals are erect) and ·12–·15″ diam., yellow, campanulate with rotate limb, in hairy peduncled umbelliform cymes about ·4–·5″ long with the peduncle. Follicles usually solitary 2–3″ by ·2–·3″ near base, gradually tapering from base to tip. Seeds ·3″.

Shahabad! Gaya Ghats! Palamau! Tundi Hills, Manbhum, *Camp.*! Khurda, Puri! It is fairly frequent in the Kaimur (Shahabad) Hills but not common elsewhere. Fl. Aug.-Sept. Fr. Jan.-March.

L. with 2–5 sec. n. of which 1 is usually from near the base, tip sometimes suddenly acute, petiole ·1–·4″ long densely pubescent. Sepals ovate or broadly oblong, hairy, margin membranous. Corolla ·06–·09″ long with lobes about as long as the tube, minutely ciliate. Corona with small fleshy callosities projecting above the sinuses of the corolla.

There has recently been a demand for this plant. It contains a principle called gymnemic acid, soluble in water. The leaves have a bitterish astringent slightly acid taste, and some time ago it was found that if chewed they have the property of destroying the taste for saccharine substances. *Mr. Hooper* more lately found that they destroyed the taste of bitter substances like quinine,* though *Cooke* says that in his own case he could not confirm this.

2. **G. hirsutum,** *W. & A.*

Said to be much stouter than the last with broader more ovate and cordate leaves, softly pubescent on both surfaces and with shorter thicker petioles. The cymes are also more sessile with umbellate stout shorter pedicels and larger flowers ·11–·13″ long and ·2–·24″ diam.

Shahabad, Rotas, *J.D.H.*!

I am unable to distinguish *Hooker's* specimen from a form of *G. sylvestre* which is often very densely tomentosely pubescent. It is in fruit and the flowers have not been seen, though I have collected true *sylvestre* from the same locality.

3. **G. tingens,** *W. & A.*

A nearly or quite glabrous climber with membranous ovate to oblong, acuminate or caudate leaves 3–6″ long, base sub-cordate, sec. n. 4–5 distinct. Petiole ·5–1·5″. Flowers pale yellow, ·25″ diam., on thinly pubescent slender pedicels ·4″ long. Peduncles ·4–·5″ long. Sepals ·04″, corolla-tube pubescent ·1″, and lobes ·1″. "Follicles 4″ by 1″, ovate-lanceolate, spreading, smooth fleshy," *Roxb.*

Monghyr, *Ham.* (*Wallich's* No. 8190A)!

* Paper read at a meeting of the Nilgiri Nat. Hist. Soc., Ootacamund, March, 1887.

16. TELOSMA, *Coville.* (Pergularia, *F.B.I.*)

Suffruticose twiners with rather large greenish or yellow flowers in sub-umbelliform cymes. Corolla salver-shaped with tube swollen at the base, lobes oblong or linear, overlapping to the right. Column rather large. Corona staminal, processes adnate to the back of the anthers, erect, laterally or dorsally flattened, 2-lamellate (in our species), the inner lamella or ligule overlapping the membranous tip of the anther and the stigma. Pollinia 1 in each cell, subterete clavate or globosely obovoid, waxy, erect. Stigma umbonate or capitate. Follicles lanceolate, terete, rather turgid.

1. **T. pallida,** *Craib.* Syn. Pergularia pallida, *W. & A.*; Kongat, Kharw., *S.*

A twining shrub with sub-watery juice, ovate acuminate often slender-petioled leaves 2–4·5″ long, thinly pubescent beneath when young, and greenish or yellowish-white flowers ·75–1″ diam. in axillary umbelliform cymes. Follicles usually solitary about 3–4″ long by ·9″ wide about the middle, rather suddenly acuminate, deeply grooved on one side.

Palamau! Santal Parganas! Chiefly in nalas and scrub-jungles. Fl. May. Fr. Nov.–Jan. Renews leaves at the time of flowering.

Stems brown, branches pale, somewhat furrowed and pustular, young with a short curly pubescence. Leaves sometimes caudate, with obtuse or sub-cordate base, when old often deeply cordate with nerves beneath shortly pubescent or glabrous, sec. n. 4–5 including 1–2 from or from near the base, slender. Petioles often only ·5″ at time of flowering, attaining 1–1·5″. Calyx ·2–·25″ long, segments oblong-lanceolate. Corolla-tube ·25–·35″ long, lobes ·3–·5″ glabrous. Inner ligule of coronal processes narrower than the elliptic sometimes apiculate outer but exceeding it, outer not as long as the anthers. Follicles poniard-shaped very smooth with a thin shell, not wrinkled when dry, thickest about the middle.

17. MARSDENIA, *Br.*

(Excluding *Dregea.*)

Twining rarely erect, shrubby or suffruticose with annual shoots from a perennial stock. Flowers mod.-sized or rather small, in umbellate cymes or clustered on the branches of a cymose cyme or panicle. Calyx 5-partite. Corolla campanulate, urceolate or sub-campanulate with spreading lobes. Corona single or double, corolline of thickened calli and a villous ring in the throat or 0, staminal of 5 appendages, fleshy often inversely V-shaped below, flattened subulate or cuspidate and membranous above with erect tips incumbent on the anther, or exceeding it and meeting over the top of the stigma, rarely obsolete. Column short. Anthers with membranous tips, pollinia 1 in each cell erect waxy narrowly clavate on slender pedicels. Stigma convex or elongated. Follicles lanceolate or poniard-shaped.

Dregea was included in *Marsdenia* by *N. E. Brown*, and that arrangement was followed by *Cooke* in the *Flora of Bombay* and by me in the *Central Provinces List*. The two genera are however very distinct in our area, and I have therefore again separated *Dregea*.

Large climber. Fls. ·3″ long, corolla tomentose . . . . . 1. *tenacissima.*
Scarcely scandent. Fls. ·18″ long. Corolla glabrous without . 2. *Hamiltonii.*

1. **M. tenacissima,** *W. & A.* Jiti, Chiti, Siti, *Kharw., H.*; Kongat, *S.*; Marawi, *Th.*; Gha, *Or.*

A stout very tough-stemmed twiner with very milky juice, all parts densely softly pubescent or tomentose. Leaves velvety to touch both sides, broadly ovate, suddenly shortly acuminate or cuspidate, 4–7″ by 3–5″ with deeply cordate base. Flowers green sub-campanulate with erect lobes ·3″ long or with spreading lobes and ·3″ diam., in corymbosely-branched tomentose cymes 2–4″ diam. which are sessile or very-shortly peduncled. Follicles 4·5–5″ long by 1·2–1·4″ diam. thickest about one-third the way from base, velvety.

Usually in the dryer hill tracts. Champaran. Sameshwar Hills! Rajmahal Hills, S.P.! Tundi Hills, Manbhum! Palamau and Hazaribagh, frequent in scrub jungles! Singbhum, rare! Angul Hills! Fl. April-June. Fr. Jan.–March. Deciduous.

Stems often ·5″ thick, permanently pubescent or puberulous. Leaves about 3″ by 2·5″ only at flowering time, adult sometimes 9″ by 8·5″ with nerves beneath and upper surface permanently softly pubescent, principal nerves 5–7, sec. n. on midrib usually only 1–2. Petiole 1·5–3″. Calyx ·15–·16 long with ellipsoid segments. Corolla lobes nearly as long as tube, broadly-oblong rounded, pubescent outside, glabrous within. Column ·18″ long, staminal corona with erect linear-oblong appendages, which curve over the top of the stigma and are often toothed at the apex, their base dividing into two fleshy ridges. Follicles solitary or usually so, tapering from the thickest part to a short thick beak which is sometimes grooved on one side and the tip of beak sometimes turned towards the groove. Seeds flat margined with a coma 2″ long.

It has a very strong fibre used for bow-strings, fishing lines, etc., and which *Roxburgh* refers to as one of the strongest he had met with in the vegetable kingdom. It has been several times recommended for cultivation.

2. **M. Hamiltonii,** *Wight.* Moron arak, *S.*; Gudgohalo, *Or.*

Stems sarmentose or ultimately scandent from a very stout woody stock. Branches pubescent. Leaves 1·5–2·75″ at time of flowering, mature 4″ by 2·4″, oblong or ovate mostly with cordate base, young with a close curly pubescence on the nerves beneath, puberulous above, mature glabrescent. Flowers yellow ·18–·2″ long with suberect petals or ·15″ long with spreading petals and ·15–·25 diam., in sub-capitate or densely corymbose axillary cymes ·8–1·3″ diam. Calyx thinly yellow-pubescent or hairy. Cor.-lobes glabrous but throat densely villous. Fruit not seen.

Tundi Hills, Manbhum, *Camp.* (under *Gymnema hirsutum*, var. in *Herb. Cal.*)! Neterhat Plateau! Sambalpur! Usually in grassy Sal jungles. Fl. April-June. Apparently dies down to rootstock annually.

Leaves obtuse or shortly obtusely acuminate, sometimes oblique, sec. n. 4-8 of which 2 from near base, looped, raised beneath, cross nervules rather straight. Petiole ·8–1·5″, young subtomentose. Cymes often bifurcate on short peduncles, hairy-pubescent, bracts small, pedicels about as long as calyx. Calyx with oval or ovate rounded segments about half as long as corolla (when the lobes are erect). Cor.-tube suburceolate or sub-campanulate, lobes broadly-oblong rounded or ovate, nearly as long as tube. Corolline corona of thickenings and a villous ring in the throat. Staminal corona fleshy with narrow membranous subulate tips as long as or longer than the anther tips but narrower. Anther tips membranous broad not quite meeting over the stigma, which has a conical tip.

The fruit is said to be eaten.

18. DREGEA, *E. Meyer.*

Twining shrubs with greenish flowers in umbelliform cymes. Corolla rotate with broad lobes overlapping to right. Corona

staminal, with fleshy spreading depressed lobes and a minute inner cusp incumbent on the anthers. Column very short fleshy, anther tips short inflexed. Pollinia 1 in each cell, narrow-oblong, erect, waxy, sessile or subsessile. Stigma conical or dome-shaped. Follicles thick hard, often ribbed when dry.

1. **D. volubilis,** *Benth.* Syn. Marsdenia volubilis, *Cooke*; Marang Kongat, *S., K.*

A stout twiner with stems attaining 1″ diam. with somewhat corky and reticulate bark and pale usually pustular or very lenticellate branches. Leaves 2·5–7″ long, ovate or broadly ovate acuminate, base cordate or rounded, sometimes even acute on some upper leaves, usually hoary with a fine curled pubescence. Flowers green ·5–·6″ diam. nearly glabrous in dense drooping umbels 1·5–2″ diam., which are sometimes several together on short branches and with peduncles 1–3″ long. Follicles solitary or usually paired and divaricate, 3–4″ long and 1–1·5″ thick, tapering from base or slightly bottle-shaped, with very blunt rounded apex, wrinkled or ribbed when dry.

Chiefly in scrub jungles. Singbhum! Manbhum! Palamau! Fl. May-June. Fr. Dec.–Feb.

Leaves never densely tomentose as in *Marsdenia tenacissima* and quite glabrescent above, strongly nerved, usually glandular at base of midrib above, sec. n. arcuate, 2–4, of which all but one are frequently close to and 1–2 at the base. Pedicels ·5–1″ long very slender in flower, woody in fruit. Calyx segments spreading, lanceolate, ·12″ long. Corolla becomes yellowish and with lobes erect in age, lobes oblong or ovate very obtuse. Corona fleshy shining green, processes gibbous with a short beak towards the stigma. Seeds obovoid, ·47″ by ·3″, margined or narrowly winged, coma 1·2–1·8″.

The juice is more or less milky but not nearly as much so as in *Marsdenia*. Fibre strong. Rind of unripe fruit used as a vegetable.

19. TYLOPHORA, *Br.*

Twining rarely erect or prostrate herbs, or suffruticose, with small or minute flowers in umbelliform or racemiform cymes. Sepals free or nearly so. Corolla rotate with broad lobes slightly overlapping to the right. Corona staminal, processes fleshy, depressed or swollen, produced down to the corolla base, often free above. Column very short. Anther-tips inflexed membranous. Pollinia 1 in each cell, minute globose or ovoid, waxy, erect or ascending or rarely transverse or pendulous from the ascending pedicel. Stigma disciform, 5-angled. Follicles acuminate usually slender or poniard-shaped. Seeds ovoid flat, winged.

Stems suberect with slender or twining tips	1. *fasciculata.*
Stems twining:—	
Usually hairy. Corona with free apical tips	2. *asthamatica.*
Glabrous. Corona without free tips	3. *longifolia.*
Stems quite prostrate. Cymes hairy	4. *rotundifolia.*

1. **T. fasciculata,** *Ham.*

Suberect slender 2–3 ft. high with several stems from a short stock furnished with numerous rather thick roots, sometimes shortly twining. L. 1·5–2″ lanceolate or somewhat ovate, acute or somewhat acuminate, glabrous or puberulous. Fls. ·17–·2″ diam. shortly racemose or umbelliform on the branches of a slender pubescent panicle

·7–1″ long. Pedicels slender ·1–·2″. Sepals narrowly lanceolate. Petals ovate acute. Coronal processes large rounded deflexed. Follicles 1–2″, pericarp rather thick for the genus.

Hills, among grass and scrub, Nilgiri State! Fl. May. Fr. Aug.-Oct.

Stems pubescent above. L. with usually acute base and 2-3 very oblique sec. n.; broadly ovate in some specimens outside our area. Petiole ·25–·4″ slender. Follicles ovoid-lanceolate.

"A decoction of the root is said to be efficacious in extremely virulent types of fever. It is somewhat poisonous," *M. S. Ramaswami.*

2. **T. asthmatica,** *W. & A.*

A twiner with subtomentose stems (in our specimens), oblong or somewhat ovate-oblong apiculate leaves 2–4″ long with rounded or sub-cordate base, pubescent beneath. Petioles ·4–1″ long. Flowers dull yellow, purple near base, ·6″ diam. on long filiform pedicels on the branches of a peduncled cyme, 1·5–2″ long. Follicles 2–4″.

Orissa, Mahanadi delta! Chilka Lake, *Hooper*! Fl. May. Fr. Sept.

The stems and leaves are variable in indumentum and some specimens are glabrous in Bengal. Sec. n. 3-5, of which 1 is from base, usually looped and not very strong. Cymes hairy. Calyx ·2″ with subulate-lanceolate hairy sepals. Petals broadly lanceolate, obtuse. Corona very large, the processes forming a closed ring with large round free lobes at base and free tips above finely acuminate.

Roxburgh states that the roots form an effective substitute for ipecacuanha.

3. **T. longifolia,** *Wight.*

A species of *Tylophora* collected by *Campbell* in Manbhum is so named in the *Cal. Herb.*, but the specimen is not in condition for satisfactory determination. It looks to me more like *T. fasciculata, Ham. T. longifolia* has quite glabrous lanceolate leaves 3–6″ long with a cordate base and elongate cymes bearing small distant umbels of small yellow flowers on the very long rhachis. Sepals ovate.

4. **T. rotundifolia,** *Ham.*

A creeping somewhat fleshy herb with prostrate pubescent or tomentose branches and opposite very shortly petioled elliptic or orbicular or very broadly ovate leaves 2–4·5″ which lie closely appressed to the soil. Fls. ·25–·45″ diam. on filiform pedicels ·5–1·3″ long in peduncled umbelliform cymes. Follicles single broadly lanceolate grooved on one side, 2·5–3″ by 1″ at the broadest part (a little below the middle), somewhat compressed, glabrous, with thick fleshy walls.

Sandstone Hills, N. Champaran! Fl. May-July. Fr. Nov.-Dec.

L. with sub-cordate base somewhat hairy or pubescent on the 3-5 strong sec. nerves beneath, lowest from near base. Petiole ·1–·2″. Bracts at top of the short or long peduncle very small and narrow, persistent pubescent. Cymes hairy. Sepals linear-lanceolate, ·15″, hairy. Petals ovate. Coronal processes swollen globose without free tips above. Seeds ·25″ brown narrowly winged, coma ·8″ white caducous.

The fruit is very unlike that of most in the genus.

20. HOYA, *Br.*

Twining or often epiphytic and pendulous with thick fleshy or coriaceous leaves and often wax-like flowers in umbels. Corolla rotate, fleshy or waxy, lobes often convex or spreading or reflexed, valvate in bud. Corona, staminal, of large fleshy or horny processes, stellately spreading or ascending, often concave on the upper surface, margins often recurved so as to enclose a hollow space, the inner

angle often produced into a tooth or spur. Column short, anthers conniving over the stigma with tips membranous, rarely 0. Pollinia 1 in each cell, erect waxy pedicelled. Follicles usually slender with thin pericarp, but variable. Seeds very small ovate or linear-oblong, coma long.

1. **H. pendula,** *Wight.*

A fleshy epiphyte with rather slender stem, twiggy pendulous branches, oblong, elliptic-ovate or -lanceolate acute thick leaves and white waxy flowers ·7″ diam. with a truncate stellate corona, in short-peduncled pendulous umbels.

Bihar (possibly Parasnath), *Kurz*! Parasnath, *Anders.* A *Hoya* occurring in Singbhum of which I have not collected the flowers may also be this.

"Branchlets and umbels sparsely hairy, leaves 1·5–3″, margins recurved, base narrow or rounded, petiole ·25–·5″. Peduncles ·5–·75″, pedicels 1–1·5″. Sepals lanceolate, shorter than the corolla-tube, corolla-lobes silkily villous," *F.B.I.*

21. LEPTADENIA, *Br.*

Twiners or erect and almost leafless shrubs, juice not milky in our species (exc. in fruit). Flowers small in axillary umbelliform cymes. Calyx 5-lobed. Corolla sub-rotate with spreading pubescent or bearded lobes, valvate in bud. Corona double; corolline of small processes in the throat between the lobes, staminal of an annular thickening or undulate wing. Column short; anthers inflexed at tip and ligulate or appendiculate, not membranous; pollinia 1 in each cell, globose, erect, subsessile, tips with a small hyaline appendage. Stigma flat, 5-gonal. Follicles hard, smooth, acuminate. Seeds flat, *F.B.I.*, winged (margins sometimes involute in fresh specimens).

1. **L. reticulata,** *W. & A.*

A twiner with corky bark, tough green branches and thick but not milky juice, young parts hoary tomentose. L. 2–3″, ovate, oblong, or some lanceolate, with very obtuse or rounded or subcordate base, mature pale and shortly hairy beneath or pubescent with rather curly hairs or glabrous, often hirtellous above. Petioles slender divaricate ·6–1″ long. Fls. greenish-white or yellow ·2–·3″ diam. in hoary peduncled axillary sometimes 2–3-nate symes. Follicles green glabrous 3–3·5″ with a long acumen and often curved tip.

Very common near the Puri coast! Angul! Fl. July–Oct. Fr. March.

Branchlets often glaucous. L. acute or cuspidate, more rarely obtuse and then mostly apiculate, sec. n. about 5–6, rather irregular, reticulations translucent when fresh. Cymes ·5–·7″ diam., rounded, dense; peduncles ·25–·5″, pedicels short up to ·25″. Calyx pubescent, lobes ovate-oblong. Cor. villous-pubescent with thick lanceolate-acuminate petals with recurved margins and grooved within at base. Staminal corona not very conspicuous. Follicles on short thick stalks, somewhat of the shape of a long-necked bottle, slightly compressed ·8–1″ broad (usually much narrower in herbaria), minutely white-dotted, juice yellowish-milky scant, endocarp rather crustaceous. Seeds ·2″ linear-obovoid with involute margins.

22. CEROPEGIA, *L.*

Twining rarely erect herbs with a tuberous rootstock. Leaves sometimes minute or 0. Flowers often large, white or greenish and

purple, in axillary peduncled umbelliform cymes, rarely solitary. Sepals narrow. Corolla-tube elongate, straight or curved, often swollen at the base, dilated above or not, lobes very various, erect or often incurved with cohering tips, often at length recurved or reflexed. Corona staminal, annular or cupular, 5–10-lobed and with 5 long ligulate processes within that are free or adnate to the anthers. Column short. Pollinia 1 in each cell, erect, sessile, with one pellucid margin. Follicles usually slender, terete.

Glabrous. Corolla lobes with cohering appendages	1. *tuberosa*.
L. pubescent, peduncled hispid. Cor. lobes suberect	2. *hirsuta*.

1. C. tuberosa, *Roxb.*

A slender twiner from a tuberous root. Leaves slightly fleshy, glabrous and shining both sides, broadly ovate or broadly elliptic, rarely lanceolate, larger 3 by 2″, upper elliptic 2 by 1″ with a long sharp apiculus. Flowers few in an umbel, 1–1·5″ long (only ·6″ in my specimens, perhaps not fully developed). Sep. subulate, ·15″. Corolla inflated at base, beaked in bud, with about 24 brown stripes within and with long reflexed hairs in the neck, lobes one-third shorter than the tube, suddenly contracted from a triangular base into linear cohering appendages. Corona near top of column, shallowly cupular, lobes ovate ciliate, opposite to each and from their base arises a long linear and clavate appendage which meet above the stigma. Follicles 4–5″ very slender. Seeds ·25″ linear.

Khurda forest, Puri! Fl. Sept.

Leaves with satiny lustre, "from orbicular to lanc." (*F.B.I.*), base rounded, sec. n. 5-6, of which 2 from base. Petiole ·5-·7″. Corolla micro.-puberulous outside. Anthers small oblong fleshy shining.

2. C. hirsuta, *W. & A.*

A hirsute climber with lanceolate to linear or (lower) broadly oblong, or a few ovate, leaves 2–3″ or attaining 5″ by 2″ with rounded or subcordate base and acute tip. Flowers 1·5–2″ long, tubular with a ventricose base about ·25″ diam. and limb ·4-·5″ diam. above the throat, with lobes erect oblong ciliate cohering. Follicles erecto-patent 3″.

Rajmahal Hills, rather scarce, *Kurz*! Manbhum, *Camp.*! Ranchi (Hundrugagh), *Prain*! Fl., Fr. Aug.–Sept.

A variable plant. The roots of true *hirsuta* are fibrous, in our plant with a flattened globose tuber. Stems with spreading hairs. Leaves membranous when dry, thinly hairy, sec. n. 2-3 fine oblique, petiole ·4-·6″. Flowers about 2 on a hairy peduncle ·4–2″ long, pedicels ·25-·5″. Sepals linear-subulate ·2-·3″. Corolla yellow with green tips or greenish blotched with purple.

Note.—*Anderson* records a species of *Ceropegia* from the top of Parasnath which I have not seen. He gives it no specific name.

23. BOUCEROSIA, *W. & A.*

(*Boucerosia* is sunk in *Caralluma* in the *Flora of Africa.*)

Fleshy leafless herbs with thick 4-angled stems not attenuate at the ends, angles toothed. Flowers terminal, large, solitary or umbelled, more or less purple. Corona annular, adnate to the column, 5-lobed; lobes 2-fid, subulate, erect or spreading with a linear fleshy process on the inner face at the sinus inflexed over the anther. Column

minute. Follicles slender straight terete, smooth. Seeds flat winged comose.

1. **B. umbellata,** *W. & A.* Syn. Caralluma umbellata, *Haw.*

A cæspitose fleshy herb or undershrub 6–15″ high, angles sinuate-dentate, the teeth ending with a scar. Flowers 1–1·25″ diam. closely concentrically streaked with purple, glabrous, in dense umbels. Follicles acuminate attaining 6″ on a pedicel of ·8″.

On bare rocks, Khandabolo Mnt., elev. 3000 ft. Puri! Fl. r.s. Fr. Dec.

Stems quite unbranched in our specimens, which are flowerless, and in the entirely sessile umbel it differs from normal *B. umbellata.* The pedicels are very short being only ·2″ in fruit, but plants with similar short pedicels have been collected in the Northern Circars. In flower the allied species *B. crenulata* can be distinguished by the long hairs scattered over the whole inner surface.

FAM. 91. LOGANIACEÆ.

Trees, shrubs or herbs with opposite simple leaves often united by a stipulary line or sometimes petioles dilated at base, more rarely stipules present and distinct. Fls. regular large or usually small, cymose, sometimes reduced to solitary flowers, cymes sometimes capitate or panicled. Calyx inferior, small, 4–5-toothed or -lobed. Corolla 4–5-lobed or -partite. Stamens 4–5, on the tube, alternate with the lobes. Ovary free 2-celled with simple style and capitate 2-fid or 2-partite stigma. Ovules 1 or more in each cell, placentæ on the dissepiment or basal in the inner angle. Fruit a septicidal capsule or baccate, 1–many-seeded. Albumen copious, embryo straight.

I. Trees or shrubs :—
  Corolla imbricate. Capsule 2-valved . . . . . 1. *Buddleia.*
  Corolla contorted. Fruit indehiscent, baccate . . . 2. *Strychnos.*
II. Herbs. Corolla valvate. Fruit a didymous capsule :—
  Fls. in 2-3-chotomous cymes, 5-merous . . . . . 3. *Mitreola.*
  Fls. solitary or clustered, 4-merous . . . . . 4. *Mitrasacme.*

1. BUDDLEIA, *L.*

Trees or shrubs. Leaves entire or crenate, often with forked or gland-hairs, united by a stipulary line. Flowers 4-merous usually rather small, variously coloured in axillary or terminal and panicled sometimes very dense or globose cymes. Calyx campanulate. Corolla campanulate, tubular, salver-shaped or sub-rotate, tube sometimes curved, lobes imbricate. Stamens in the tube with short filaments. Ovary 2-celled, style short with clavate or capitate stigma. Ovules very many. Fruit a septicidal capsule. Seeds very many, oblong or fusiform with usually loose testa expanded into a wing or tail, albumen fleshy.

1. **B. asiatica,** *Lour.* Nimda, *Beng.*; Jhangi, *Th.* (but this merely means a shrub).

A pretty shrub 3–7 ft. high, clothed on the branches and leaves with a hoary or grey tomentum. Leaves lanceolate 3–6″ long, acuminate. Flowers small white ·12–·2″ long in small cymose clusters on the rhachis of spiciform panicles, these again often

panicled. Capsule reflexed oblong ·17–·2″ long crowded on drooping panicled racemes 4–6″ long and supported by the persistent calyx.

Frequent in Champaran and Purneah! Occasional elsewhere near streams and in ravines. Singbhum! Santal Parg.! Manbhum, *Camp.*! Palamau, ascending to Neterhat, 3000 ft! Parasnath, *Prain*! Fl. Dec.–Feb. Fr. Feb.–March. Evergreen.

Leaves narrowed at the base into a short petiole. Spikes 3–6″. The flowers in the Central area are usually very small and do not attain ·15″ except in a specimen from near the Soane River. Anthers subsessile. Stigma clavate. Seeds very minute linear or ellipsoid, brown.

Exotic species of *Buddleia* are often seen in gardens, especially *B. madagascariensis, Lam.*, with yellow flowers.

2. STRYCHNOS, *L.*

Erect or scandent trees or shrubs with palmately- or penni-nerved opposite leaves with stipular lines between the petiole-bases. Flowers 4–5-merous in terminal or lateral cymes with small bracts. Calyx small, lobed. Corolla salver-shaped, campanulate, or rotate, lobes valvate. Ovary 2-celled or 1-celled above, style usually long, stigma capitate or 2-lobed. Ovules many. Fruit baccate, 1–many seeded, sometimes with coriaceous or woody pericarp. Seeds globose, discoid or oblong with horny albumen and small embryo.

The scandent species do not occur in our area; they bear axillary tendrils.

Corolla-tube ·2″. Leaves palmi-nerved, petiole ·3–·5″ . . . 1. *nux-vomica*.
Cor.-tube ·12–·17″. L. palmi- or penni-nerved. Petiole under ·2″ . 2. *potatorum*.

1. S. nux-vomica, *L.* Kochila, *Beng., Or.*; The Strychnine tree.

A large, handsome or, on poor soils, often a small tree, with ovate or sub-orbicular shining leaves 2–4″ long with three strong and two weaker nerves from close to the base and petiole ·3–·5″ long. Flowers white or greenish-white tubular or salver-shaped with short lobes, in short peduncled cymes mostly at the ends of short branchlets. Fruit globose bright orange 1–2″ diam. The discoid satiny seeds are surrounded by a white intensely bitter pulp.

Very common, chiefly as a small tree, on the laterite of Puri! Along the banks of the Mahanadi, in high forests, Angul! Rather common in Daspalla, Nayagarh and Narsingpur States but grows less common in the more northerly Orissa States, *Cooper*. Occasional in Chota Nagpur, but always near villages and probably not indigenous! Often planted. Fl. March–April. Fr. Dec.–Jan. Nearly or quite evergreen, new leaves in March.

Bark smooth, grey. L. very obtuse or rounded; rounded at base, or suddenly acute on the petiole. Cymes minutely pubescent, peduncles ·3–1″ long. Fls. ·27–·3″ long when the lobes are erect, calyx very small, corolla-tube ·2–·25″ long, throat glabrous. Stigma entire. Seeds several ·5″ diam. often depressed in centre.

The dried ripe seeds are the *Nux-vomica* of the British Pharmacopœia. Merely powdered they are a valuable tonic and largely used as a tonic for horses, which eat it if mixed with their food. They are the chief source of strychnine. The pulp is apparently eaten by some animals and birds and small quantities appear to be harmless to man, but it is intensely bitter. *Gamble* and *Brandis* state that the wood is bitter and not eaten by white ants! The weight is given as 54 lbs. The seeds germinate about August and the growth of two plants sown by me averaged 24 ft. in height and 19″ girth after 16 years. These were, however, watered when young. The seedlings have palmately 7-nerved sessile first leaves (or cotyledons?) 1–2″ long.

2. S. potatorum, *L.f.* Nirmali, *H.*; Koyar, *Or.*; Kotaka, *Cr.*; The Clearing Nut.

A small densely branched tree with blackish cracked bark and

elliptic or ovate leaves 1·5–5″ long with nervation much as in the last or sub-penniverved; easily distinguished by the very short petioles, usually under ·2″ long. Flowers white in dense glabrous cymes mostly at the axils of fallen leaves with campanulate corolla only ·12–·18″ long. Fruit globose ·5–·7″ diam. with firm pericarp, thin pulp and usually only 1, sometimes 2 large thickly lenticular seeds ·4–·5″ long.

Not common, and chiefly in the Southern Area: Puri, in Muktapur jungles! Angul, frequent! Athmallik, near streams! Narsingpur! Sambalpur, in the Jhargati and Hathibari forests! Kalahandi! In the Central area it is reported in the *Him. Journals* as occurring along the Sone, and by *Anderson* as on Parasnath. Manbhum, *Camp.* (wild?)! Fl. May. Fr. Oct.–Feb. Sometimes deciduous in May, when the flowers appear on the bare branchlets and are immediately succeeded by the new leaves.

L. usually acute or subacute both ends, quite glabrous, with usually 2 strong lateral nerves each side which curve and nearly reach the tip and are joined by a number of weaker sec. n. Peduncles of cyme hardly any. Flowers fragrant; corolla-tube with tufts of white hair in the throat; lobes longer than the tube. Ovary gradually tapering into the short style. Stigma capitate, slightly 2-lobed.

Brandis states that the wood is durable, hard and close-grained. Wt. about 58 lbs., *Gamble*. The seeds rubbed round the inside of a vessel have the remarkable property of clearing muddy water. The fruit is used for poisoning fish, but the pulp is said to be eaten.

The seeds rubbed with water and salt are also used for conjunctivitis.

3. MITREOLA, *L.*

Herbs with opp. membranous leaves and small or membranous stipules. Flowers small white in 2–3-chotomous and unilateral helicoid cymes. Corolla urceolate 5(–6) lobed, lobes small, valvate. Stamens included. Ovary 2-celled, styles 2 connate in the stigma, ultimately divergent, placentæ peltate, ovules many. Fruit a laterally compressed truncate or 2-horned capsule, dehiscing from the top of the septum downwards. Seeds very many, minute, globose or elongate, albumen fleshy. Embryo linear.

1. M. oldenlandioides, *Wall.*

A slender erect herb 6–18″ high with ovate or ovate-oblong acuminate, or oblong (*F.B.I.*), leaves 1·5–3″ long and terminal and axillary panicles of minute white flowers soon passing into the laterally compressed obcordate 2-horned fruits ·15″ long and broad. Branches of panicle 2-chasial with a sessile flower in the fork, ultimately with the flowers or capsules sessile and unilateral.

Rajmahal Hills, *Kurz*! Singbhum! Hazaribagh and Manbhum, *Clarke*! Fl., Fr. Oct.–Nov. Annual.

Leaves puberulous, occasionally only 1–1·5″ long and ·5–·9″ wide, described in *F.B.I.* as oblong and tapering at both ends; mine have a rounded base suddenly acute on the petiole which is ·3–·5″ long; sec. n. fine distinct, about 8. Fls. sessile or subsessile. Horns of capsule short incurved.

4. MITRASACME, *Labill.*

Small herbs with opposite or ternate leaves and stipules forming a minute sheath. Flowers small, white, terminal or axillary, solitary clustered or in irregular umbels, 4-merous. Calyx campanulate. Corolla urceolate, lobes valvate. Stamens included. Ovary 2-celled, styles 2, at first connate, usually finally divergent. Ovules many. Capsule subglobose or subcompressed truncate or 2-horned, dehiscing

from above downwards. Seeds very many, minute, subglobose, testa smooth reticulate.

1. M. alsinoides, *Br.*

A small very slender herb 3–6″ high, resembling one of the Caryophyllaceæ or Oldenlandiæ, with erect weak stem and opposite linear or lanceolate leaves ·2″ long which have raised glistening epidermal cells (like those of *Oldenlandia crystallina*). Flowers solitary axillary, pure white, ·12–·15″ long and about ·1″ diam. on slender pedicels ·5–1″ long. Calyx ·08″, sepals somewhat cuspidate in fruit, capsule ·08″.

Singbhum! Hazaribagh, in swamp, *Clarke*! Fl., Fr. Oct.–Nov.

FAM. 92. GENTIANACEÆ.

Herbs (aquatic in *Limnanthemum*) with opposite, rarely alternate, entire, simple (3-foliolate in a genus outside our area) entire leaves, often basal-nerved. Flowers small or showy, regular or (*Canscora* and *Hoppea*) irregular especially in the stamens, mostly in ebracteate cymes, sometimes clustered. Calyx inferior, lobes 4–5 imbricate in bud. Corolla funnel-shaped or rotate, lobes imbricate or twisted to the right. Stamens on the tube, alternate with the petals, sometimes unequal or some altogether suppressed, anthers dehiscing longitudinally or by apical pores. Disc 0 or of glands. Ovary free, 1-celled, or more or less 2-celled by intrusion of the parietal placentæ. Style 1, stigmas 2. Ovules numerous. Fruit capsular, often membranous, rarely baccate. Seeds numerous, small. Albumen copious.

I. Terrestrial herbs. Leaves opposite :—
  A. Flowers regular or nearly so :—
    1. Ovary 2-celled. Style filiform . . . . . 1. *Exacum.*
    2. Ovary 1-celled :—
      a. Style short or 0. Corolla with glands at base . . 2. *Swertia.*
      b. Style slender . . . . . 3. *Erythræa.*
  B. Flowers irregular, usually only 1–2 stamens perfect :—
    Calyx tubular. Stigmas 2 . . . . . 4. *Canscora.*
    Calyx campanulate. Stigma subentire. Minute herbs . 5. *Hoppea.*
II. Aquatic herbs with alternate or subopp. leaves . . . 6. *Limnanthemum.*

1. EXACUM, *L.*

Stems often angular with usually 3–5-basal-nerved leaves. Flowers regular, or slightly zygomorphic, in terminal and axillary cymose panicles. Calyx deeply 4–5-lobed. Corolla rotate with globose tube, blue or white. Stamens on the throat, filaments short, anthers with apical pores at length dehiscing to the base. Ovary more or less completely 2-celled, style long, stigma small sub-capitate. Capsule globose, septicidally 2-valved. Seeds very many, minute, subcuboid, testa granular.

A. Flowers ·75–1·5″ diam. Stems 1–3 ft. high :—
  Fls. deep blue. Calyx wings small . . . . . 1. *tetragonum.*
  Fls. with white base. Calyx distinctly winged . . . 2. *bicolor.*
B. Fls. ·5″ diam., blue or white. Stem 3–12″. Calyx winged :—
  L. lanceolate or ell., subsessile, 3-nerved. Calyx-wing lanceolate . . . . . 3. *pedunculatum.*
  L. ovate or broadly-ell., petioled, 4–7-nerved. Calyx-wing ovate . . . . . 4. *petiolare.*

1. E. tetragonum, *Roxb.* Kuchuri, *Beng.*

A lovely plant with 4-angled stems 1–2 ft., sometimes 3 or more ft. high, with sessile broadly lanceolate leaves 3–5″ long, often united at their bases, and narrow panicles of azure-blue flowers ·75–1·5″ diam. with ovate petals and bright yellow anthers.

In damp, wet or grassy places in the open or glades in the forest. Not uncommon throughout Purneah! Santal P.! and Chota Nagpur! Perhaps in all districts. Fl. Aug.–Dec. Fr. Nov.–Jan.

Glabrous. L. decussate, mostly 5-nerved, shining above. Calyx deeply 4-lobed, winged or keeled. Stigma exserted from the bud (flower probably protogynous). Capsule broadly oval ·25–·27″, dehiscing laterally through the septum which is only partial in fruit, the central portion with the large dry placentæ lying loose in the cells. Seeds very minute, pale brown.

2. E. bicolor, *Roxb.*

Clarke says that it is frequent from Orissa southwards, but I have seen no specimens from north of Ganjam (which used to be included in Orissa). The flowers are said to be unsymmetric, the buds distinctly curved at the tips, and the anther cells curving and tapering upwards. But the fls. of *E. tetragonum* are sometimes slightly zygomorphic. The species is included in Bengal plants apparently on the strength of the Orissa locality.

3. E. pedunculatum, *L.*

A slender erect herb, strict or ramose, 3–12″ high, with 4-angular stems, narrow-elliptic or lanceolate sessile or subsessile leaves ·5–1·7″ long and usually pale-blue flowers in terminal few–many-fld. cymes. Calyx ·15″ long with ovate lobes and a lanceolate dorsal wing. Corolla exserted ·25–·3″.

Not common. Hazaribagh, *Clarke*! Plains of Bihar, *Kew Herb.*! Fl. Nov.

4. E. petiolare, *Griseb.*

A small herb 3–12″ high, usually branched above only, with ovate or elliptic-ovate leaves 1·5–3″ long, 4–7-nerved, with broad base suddenly tapering into a slender but short petiole. Flowers 4-merous, white or bluish, axillary and in terminal cymes. Size of flowers rather variable (as probably in last) and calyx increasing in size in fruit when it is conspicuous by the large ovate acuminate veined wing at the back of each lobe. Wing in fruit ·4″ long. Seeds small brown angled subquadrate.

Moist banks and damp situations generally, in shade. Singbhum! Parasnath! Fl., Fr. Sept.–Nov.

2. SWERTIA, *L.*

Herbs with leaves often 3-basal-nerved and white, blue, or lurid, regular flowers in cymose panicles. Sepals 4–5, usually lanceolate. Corolla rotate, lobes 4–5, twisted to the right; at the base of each are 1–2 glandular pits or depressions, sometimes partly covered by a scale and with margins more or less fimbriate. Stamens 4–5, inserted near base of corolla, filaments often dilated downwards, anthers versatile. Ovary 1-celled, placentæ little-intruded; style short or 0, stigmas 2. Capsule sessile, separating into its 2 carpels. Seeds rarely few, testa close or very lax or winged, reticulate.

1. **S. angustifolia,** *Ham.*, inc. S. pulchella, *Ham.*, and S. affinis, *Clarke*; Chiretta, *H.*; Chirainta, *Birja*; Bonga Marchi, *K.*

A pretty, erect or diffuse herb 1–3 ft. high, with stems 4-angled above, long linear or linear-lanceolate sessile 3-nerved or sub-3-nerved leaves 2–4″ long, and white or very pale blue 4-merous flowers ·5–·7″ diam. in numerous panicles, or the flowering branches forming one very large panicle. Each petal with one large gland at base.

Common in grassy glades in the valleys, and on the tops of high hills in open grassy situations. Fl. Oct.–Dec.

The following varieties occur :—

α. **Wallichiana,** *Burkill.*

Inflorescence lax. Sepals very long linear acuminate attaining ·6″, longer than the ·25–·3″ long petals which are white without black markings. Gland very large.
Ramnagar Hills!

β. **pyramidalis,** *Haines.* Syn. S. pulchella, *Ham.*, in part, var. pulchella, *Burkill?*

Leaves lanceolate 2″. Branches of inflorescence long, the whole forming a large ovoid panicle. Sepals ·25–·3″ equal to or shorter than the petals which are mostly about ·3″ oblong-obovate, looking bluish from the numerous purple dots or dashes. Gland very large.
Neterhat, 3300 ft.!

γ. **pulchella,** *Burkill.* Syn. S. affinis, *Clarke.*

Leaves often very long linear, over 3″. Branches of inflorescence lax and very numerous, usually forming an oblong panicle. Flowers much as in last but gland usually smaller.
Chota Nagpur, all districts! Purneah!

3. ERYTHRÆA, *Rich.*

Erect herbs with opposite sessile leaves and regular white or rose flowers in dichotomous cymes. Calyx tubular with 5 narrow keeled teeth. Corolla salver-shaped. Stamens 5 near top of tube. Ovary 1-celled, placentæ far-intruded, style linear, stigmas 2. Capsule oblong, about as long as calyx, nearly 2-celled, 2-valved, cells separating. Seeds very small, reticulate.

1. **E. Roxburghii,** *G. Don.*

A pretty little plant 2–8″ high with numerous persistent radical obovate or elliptic leaves about 1″ long, and smaller narrower cauline. Flowers rose-coloured with very slender corolla-tube, ·27–·3″ long, long-pedicelled, in repeatedly branched dichasial cymes with small bracts.

In fields. Behar, *T.A.*! Sahibganj, S.P., *Kurz*! Bettiah, *Hieronymus*! Fl. March–April.
It somewhat reminds one of a miniature English "Centaury" and sometimes of *Canscora diffusa.*
Radical leaves usually obtuse. Pedicels in the forks of the cyme ·25–·5″. Calyx ·2″. Corolla-lobes spreading, very small.

4. CANSCORA, *Lamk.*

Annual 2-chotomously branched herbs, with sessile, perfoliate or petioled often 3–5-basal-nerved leaves. Flowers often small, more or less irregular, white or pink, axillary and in terminal cymes or (not

in our species) spicate. Calyx tubular, 4-toothed, sometimes winged. Corolla-tube about as long as calyx, lobes 4, often unequal, imbricate in bud. Stamens near top of tube, 1 or 2 longer than the others which are usually reduced to staminodes. Ovary 1-celled, placentæ not much intruded, style linear, stigmas 2 short. Capsule oblong, 2-valved, separating into its 2 carpels or breaking up irregularly. Seeds very small, polyhedral, dark brown, reticulate.

A. Calyx wingless, branches and pedicels slender wingless :—
Leaves (or bracts) on the panicle broadly ovate . . . . 1. *diffusa*.
Bracts on the manicle linear, minute or 0 . . . . . Var. *tenella*.
B. Calyx winged or not, pedicels sub-alate or winged :—
Calyx neither striate nor winged . . . . . 2. *decurrens*.
Stem, pedicels and calyx distinctly winged . . . . . 3. *decussata*.

1. **C. diffusa,** *Br.*

A pretty little plant 6–18″ high, repeatedly dichotomously branched or finally dichasially branched with very slender branchlets, a pair of sessile broadly ovate leaves or bracts at each fork and small pink flowers on capillary pedicels which are sometimes finely 4-angled. Calyx ·2–·28″, tube striate with setaceous teeth as long or nearly as long as the corolla-tube. Limb of corolla ·12–·17″ long. One stamen conspicuously larger than the other three.

On moist banks and wet rocks. Common in Chota Nagpur, all districts ! Angul, *B. Chattarjee* ! Probably in all districts. Fl., Fr. all the year.

Lower leaves oblong or oblong-oblanceolate, acute or shortly acuminate, ·8–1·8″ long, 3-nerved a little above the narrow base, lowest shortly petioled.

Var. **tenella,** *Clarke.* Syn. C. tenella, *Wight.*

This differs conspicuously in the narrow lanceolate leaves and the absence of the large ovate bracts. It is distinguishable from the next species by the persistent dichotomy, whereas *C. decurrens* is to a great extent 3-chotomous with the central branch the strongest, the habit therefore less open; the pedicels of *C. decurrens* are much coarser and sub-alate.

2. **C. decurrens,** *Dalz.*

Erect 4–12″, 2–3-chotomously branched above, branchlets less slender, narrowly winged, bracts the same shape as the leaves or upper subulate. Flowers small, pink, on 4-ridged or sub-alate pedicels. Calyx ·25–·28″ long, not at all striate nor winged, sometimes slightly keeled at back of the teeth only, teeth short, rather bluntly subulate, shorter than the corolla-tube. Limb of corolla ·17″ long, one petal larger than the others and two connate rather higher up forming a pseudo-lip opposite to the larger stamen. Stamens subequal or one with only slightly longer filament.

Bunds of rice-fields. Singbhum ! Fl., Fr. r.s.

Lower leaves lanceolate ·7–1·3″ long, very acute or apiculate, 3-nerved, upper narrowly lanceolate and passing into linear-subulate bracts. Capsule 2-valved to base, linear-oblong, ·18″ long.

A very different plant to the last, but of which *Clarke* (*F.B.I.*) writes, "very doubtfully distinct from *C. diffusa*, var. *tenella*" ! Small specimens are sometimes reduced to a single peduncle and flower.

3. **C. decussata,** *Roem. & Sch.* Kalmeg, *K.*; Sankhahuli, *H.*; Dankuni, *Beng.*

An erect mostly 3-chotomously branched herb 6–15″ high with 4-winged stem branches and pedicels, lanceolate or oblong-lanc. sessile

3-nerved leaves ·17–1″ long below, gradually smaller upwards and bractiform on the inflorescence. Flowers white, very irregular, sublabiate. Calyx ·3–·4″ with veined lanceolate wings and small sharp teeth. Tube of corolla as long as calyx, limb ·2″. One stamen conspicuously larger than the three others. Capsule oblong, shorter than calyx, 2-valved to base.

Chota Nagpur, frequent, esp. on clay in the forests! Angul, *Chattarjee*! Fl., Fr. Sept.–Feb.

Used as a tonic, laxative and in fever. *Dutt* says that it is also much prized as a nervine and used in insanity and nervous debility.

5. HOPPEA, *Willd.*

Small, much branched, glabrous herbs with small sessile leaves and small white or green flowers, sessile or shortly pedicelled in 2–3-chotomous cymes. Calyx campanulate, 4-lobed. Corolla with subglobose or tubular tube and 4 (or 8) short or long, usually unequal lobes. Stamens with one only perfect and 3 barren, in the throat with short filaments and ovate anthers dehiscing introrsely. Ovary 1-celled, placentæ not far intruded, style short, stigma subentire. Capsule short, 2-valved. Seeds very many, minute.

1. H. dichotoma, *Willd.*

A minute herb, often only 1–2″ high, sometimes 4″, densely branched, with 4-winged stems and opposite sessile ovate leaves ·2–·25″ long, becoming lanceolate and bractiform on the inflorescence. Flowers very small, appearing green, but with a white corolla, in dichasial cymes and in the forks of the dichotomous branches. Capsule subglobose.

Damp open ground. Purneah, common! Chota Nagpur, common! Probably throughout the province. Fl., Fr. c.s.

Calyx ·08–·1″ long with lanceolate lobes equalling the tube, each with 2 green nerves uniting in a very acute tip, hyaline between the nerves. Corolla regular or nearly so, white, membranous, urceolate, sometimes with 4 very short oblong obtuse lobes, sometimes with 8 lobes and sometimes lobes triangular.

This little plant reminds one of the European *Scleranthus annua*.

6. LIMNANTHEMUM, *Gmel.*

Aquatic herbs with alternate or subopposite deeply cordate leaves. Flowers white or yellow, clustered at the nodes, 4–5 (–7)-merous. Corolla rotate, deeply cleft into valvate lobes which are ciliate, fimbriate or longitudinally folded down the middle, tube often with glands opposite the lobes. Stamens with short filaments and versatile anthers. Ovary 1-celled, placentæ 2–3, not intruded, style short, stigmas 2–3-lamellate. Capsule ovoid or oblong subindehiscent. Seeds numerous, orbicular, compressed, testa close, rather spongy, finely reticulate, sometimes papillose.

Fls. 1·5″ diam., corolla densely white-bearded . . . . . 1. *indicum*.
Fls. ·5–·75″ diam. Petals with a median lamella, not bearded . . 2. *cristatum*.

1. L. indicum, *Thwaites.* Syn. Menyanthes indica, *L.*

An aquatic with floating leaves resembling those of a small waterlily, and very beautiful white flowers 1·25–1·5″ diam., with fringed

petals and yellow centres, borne in fascicles at the nodes, but only 1 or 2 flowering at a time.

Very common in tanks and backwaters, in all districts! Fl. June-Sept.

Stems numerous from a rhizome, long and slender, looking like long petioles were it not that they bear the inflorescence about half or three-quarters of an inch below the leaf. Leaf rather fleshy, orbicular or orb.-oblong, deeply cordate with an acute sinus, 3–8″ diam., beneath verrucose, above smooth, palmately-nerved, margin sinuate. Flowers in a dense sessile umbel on long pedicels which are deflexed after flowering. Sepals 5-7, narrow, green. Petals often 6, linear-oblong with entire recurved margins, beautifully densely fimbriate on the surface with long white hairs. St. 5-7. Ovary with 3 parietal placentæ and 3-lamellate stigma (sometimes 2, ?).

2. **L. cristatum,** *Griseb.*

Closely resembling the last, but smaller in all its parts. Stems long filiform, leaves floating elliptic to orbicular 2–3″ diam. Flowers borne on slender pedicels which rise one by one above the water to open and the pedicels then recurved. Corolla ·5–·75″ diam., petals not hairy, but with a median vertical lamella, base yellow, throat with a ring of hairs.

In similar places to *L. indicum*, and flowering with it!

FAM. 93. HYDROPHYLLACEÆ.

Herbs without milky juice, sometimes glandular-hairy. Leaves simple or pinnate, exstipulate, alternate. Inflorescence various. Flowers regular, usually 5-merous. Sepals shortly connate at base, imbricate. Corolla usually rotate, lobes imbricate in bud. Stamens inserted near base of corolla, alternate with the petals, equal or not, filaments often hairy or dilated below. Anthers linear or sagittate versatile. Disc seldom developed. Ovary superior with broad base, 2-carpellary, 1–2-celled, often with a partial septum, placentæ 2 in each cell axile or at the margins of a partial septum. Styles 1–2, if one then more or less divided. Stigmas usually capitate. Ovules in each carpel many to 2, sessile or pendulous, anatropous or amphitropous, micropyle superior and exterior. Fruit capsular, loculicidally 2-valved, so that half the septum with the placentæ remain in the middle of each valve or valves separating from the septum. Seeds as many as the ovules or fewer, albuminous. Embryo small straight axile.

1. HYDROLEA, *L.*

Leaves simple entire. Flowers in short terminal panicled racemes or cymes. Corolla sub-rotate. Ovary completely 2-celled, styles distinct with capitate stigmas. Ovules very many. Capsule septifragal, 2-valved or wall irregularly breaking up.

1. **H. zeylanica,** *Vahl.*

An erect or diffuse herb 1–2 ft., often succulent, glabrous below. Lower leaves 4″ by 1″, lanceolate, acuminate, upper gradually smaller and bracteate. Inflorescence cymose at the ends of short lateral branches and terminal, panicled by the suppression of the leaves. Flowers blue, ·4″ diam. Capsule ovoid-ellipsoid, ·17″ long, septifragal.

Marshy ground and rice-fields. Purneah, common! Bettiah, *Hieronymus*! Gaya, *Meebold*! Chota Nagpur, frequent! Angul, *Chattarjee*! Probably therefore in all districts. Fl., Fr. Jan.–Feb. There are two varieties, of which the erect form is a very pretty plant when in full flower :—

α. **erecta.** Erect with cauline leaves reflexed attaining 3–4″, shortly petioled (as in the next). Cymes terminating the numerous often elongate lateral branches, pubescent but not glandular.

Marshy places, Purneah!

β. **diffusa.** Procumbent and rooting at the nodes, leaves rarely exceeding 2″. Cymes very numerous, glandular-hairy as well as pubescent.

The common form in rice-fields.

FAM. 94. POLEMONIACEÆ.

Herbs, shrubs or trees, sometimes scandent, often glandular. with simple or pinnate exstipulate alternate leaves or lower sometimes opposite. Flowers often showy, regular or (*Cobæa*) somewhat zygomorphous, usually cymose, hermaphrodite, 5-merous. Calyx inferior. Corolla gamopetalous, variously shaped, lobes twisted to the right. Stamens on the tube, alternate with its lobes. Ovary mostly 3-carpellary and 3 (–5)-celled. Style simple 1, sometimes 3-fid. Ovules very many. Fruit capsular 3-valved, sometimes with partial false septa in the middle of the valves.

Cobæa scandens, *Cav.* A large climber with the rhachis of the pinnate leaves converted into tendrils at the end, and large campanulate somewhat zygomorphic solitary axillary flowers with large cordate bracts.

Often seen in gardens in the cooler parts of the province.

Phlox Drummondi, *Hook.* A well-known garden plant.

FAM. 95. BORAGINACEÆ.

Trees, shrubs or more frequently herbs, often with cystoliths or hispid hairs, alternate (subopposite in some *Cordia*), or lower sometimes opposite, simple, exstipulate leaves and usually small regular, very rarely zygomorphous, flowers in dichotomous scorpioid cymes which are most often circinate when young, rarely solitary or subracemose. Flowers usually 5-merous, exceptionally 4- or 6–8-merous. Corolla often with scales in the throat, imbricate (rarely twisted) in bud. Stamens on the tube, usually equal, anthers introrse. Disc often present annular hypogynous. Ovary of two median carpels, 2-celled, but very soon 4-celled by the formation of false septa, and ovary frequently (tribe Borageæ) 4-lobed with the style from between the lobes. Ovules suberect, 2 to each carpel, one from the inner basal angle of each cell. Fruit drupaceous and with a 4-celled stone or two 2-celled stones or 4 pyrenes or breaking up into 4 nutlets. Seed straight or curved, usually scanty albumen. Embryo straight or curved (not spiral as in Convolvulaceæ), with cotyledons flat, plano-convex or plicate, radicle superior.

I. Ovary entire with terminal style. Fruit drupaceous :—
  A. Style twice 2-partite :—
    Trees or large shrubs. Calyx teeth short, often unequal . . . . . 1. *Cordia.*

B. Style once 2-partite or divided to the base, or entire :—
1. Styles 2, or one 2-fid :—
Trees or shrubs . . . . . 2. *Ehretia.*
Prostrate herb. Fls. often axillary . . . . 3. *Coldenia.*
2. Style 1 undivided :—
Shrub. Fls. in few-fld. racemes or sub-solitary . 4. *Rhabdia.*
Herbs. Fls. in scorpioid cymes. Style-apex disciform . . . . . 5. *Heliotropium.*

II. Ovary 4-lobed, with style from between the lobes (exc. 6), fruit of four nutlets (or 3-1 by suppression). All herbs :—
A. Style terminal. Fruiting calyx accrescent . . . 6. *Trichodesma.*
B. Style from between the lobes (Borageæ) :—
Cymes racemiform, scorpioid. Nutlets glochidiate . 7. *Cynoglossum.*
Flowers axillary or upper in a bracteate raceme. Nutlets granular-scabrid . . . . . 8. *Bothriospermum.*

NOTE.—The large group of Borageæ, to which the Forget-me-nots, Borage, Alkanet, etc., belong, is better represented in temperate regions.

1. CORDIA, *L.*

Trees or shrubs often with cystoliths (best seen when dry) and a marginal nerve in the leaves. Flowers in 2-chotomous corymbose cymes or clusters, ebracteate, polygamous. Calyx tubular or campanulate, accrescent in fruit, teeth usually short, often irregular. Corolla tubular or funnel-shaped with 4–8 recurved petals. St. 4–8 usually hairy at the base, anthers large exserted. Ovary 4-celled. Style twice 2-partite. Drupe with a hard 1–4-celled putamen. Seeds exalbuminous.

The cystoliths appear as superficial discs on the dried leaves, but mature leaves are required for comparison of one species with another. Owing to the usual absence of old leaves in herbaria and to my not having been able to collect flowers from the same trees as the mature leaves I am doubtful of some of the following forms.

I. Shrubs or very small trees. Leaves mostly under 3″ long :—
Leaves sub-opposite, oblanceolate entire or undulate . . . 1. *Rothii.*
Leaves alternate, elliptic, dentate, scabrous above . . . 2. *monoica.*

II. Trees. Mature leaves over 3″ long :—
A. Leaves under 5″ long, not cordate-ovate nor broadly-ovate :—
L. oblong, elliptic or obovate. Petiole slender . . . 3. *myxa* (*obliqua*).

B. Leaves mostly cordate-ovate or broadly ovate, over 5″ :—
L. glabrous, entire, ovate or elliptic-ovate, petiole under one-fourth blade . . . . . 4. *sp.?*
L. glabrous, sinuate-dentate, acuminate. Petiole about one-fourth blade . . . . . 5. *sp. nov.?*
L. mostly cordate white-tomentose beneath, mostly obtuse, petiole one-third to half-blade . . . . . 6. *Macleodii.*
L. stellate-pubescent or -puberulous beneath, acute, petiole under one-third blade . . . . . Var.?

1. C. Rothii, *R. & Sch.*

A small tree with sub-opposite oblong-oblanceolate leaves, 1–2″ long at the time of flowering, attaining 3–4″ when mature, entire or undulate, pubescent beneath when young and hirtellous above, mature scabrid with white discs when dry. Flowers small white with calyx ·12″ long, corolla-tube included, petals 4 spreading oblong, ·05–·1″. Fruit oblong-ovoid ·25″ acute seated on the cupular calyx which is ·25″ wide in fruit.

Behar, *Kurz*! Fls. May–June with the new leaves. Fr. Sept.–Oct.
Leaf penninerved with about 6 rather obscure sec. nerves. Petiole ·3–·6″. Cymes 1–3″ diam. pubescent.

2. **C. monica,** *Roxb.*

A shrub usually under 6 ft. in our urea, or a small gnarled tree, with the flowers and new leaves fasicled or densely corymbose, on short shoots. Shoots and new leaves beneath white- or fulvous-tomentose, old leaves elliptic, ovate or obovate, 1–3″, obtuse, dentate or crenate-denticulate with strong excurrent nerves, pubescent beneath, scabrous above, with close white cystoliths. Corymbs or fascicles only 1–2″ diam., tomentose. Fruiting calyx broadly campanulate, ·3″ long and broad, shortly irregularly lobed, scarcely ribbed. Drupe ovoid ·4–·5″ yellow, beaked when young.

Gangpur, Hazaribagh and Palamau, in dry jungles! Common on the Rhotas cliffs, Shahabad! From Orissa southwards, *Clarke* (in *F.B.I.*), but there appear to be no specimens from our part of Orissa. Fl. May-June. Fr. Nov.-Dec. Deciduous, flowers with the new leaves like most of the species.

Branchlets brown, not markedly lenticillate. L. tomentose both sides when young with 3-5 strong sec. n. of which one from the base, branches ending as points in the margin, tertiaries strong sub-parallel raised beneath, marginal nerve strong. Petiole ·25–·4″. Flower buds apiculate, calyx in flower ·2″, in fruit ·3″, pubescent or tomentose, teeth villous. Corolla lobes ·2″, narrow. "Males usually 4-androus, fem. 5-androus. Stone 4-celled, drilled at apex, 3 cells barren," *Clarke*.

3. **C. myxa,** *L.** Hemrum, *K.*; Buch, *S.*; Bahuar, Balanjan, *Kharw.*; Lasura, *H.*; Bohari, *Beng.*; Dhuanl, Gwhalo, *Or.*; Bahalphal (Sambalpur); Sebesten.

A small tree, usually with drooping branches and ashen twigs, only hairy when young. Leaves orbicular, ell.-oblong or obovate, but neither cordate (rarely with a very short triangular tip) nor acuminate, 2·5–5″ long, entire or sinuate, not, or scarcely, scabrid above, hairy in the nerve-axils beneath. Petiole slender ·7–1·5″. Flowers white, fragrant, in corymbose, often panicled glabrous cymes usually terminating short lateral branches, sometimes panicle long-peduncled. Calyx not ribbed, globose in bud, funnel-shaped ·16–·2″ in flower, soon accrescent becoming broadly campanulate to saucer-shaped and ·5–·75″ diam. in fruit. Fruit conical when young, ripe ovoid ·5–·75″, yellowish or pinkish, glassy, with very viscous 1-seeded pulp.

Frequent throughout the area! Most usual in the damper districts or along streams in the dryer. Fl. March-April. Fr. July-Aug. Nearly evergreen, flowers with well-developed leaves.

Bark brown with shallow wrinkles and furrows, blaze at first nearly white quickly turning brown on exposure to the air. Innovations often densely fulvous, somewhat stellate-pubescent and with longer hairs intermixed. L. 3-6-nerved at the base with other sec. n. 3-4 each side, smooth above to the naked eye but under the lens marked with small white dots, rarely also with scattered and grouped discs, nervules very reticulate. Cymes 2-4″ diam. Corolla-tube as long as calyx, lobes ·17″ long, linear-oblong.

The wood is used for agricultural implements and as fuel. The fruit is said to be eaten, but is exceedingly viscous. "The mucilage is demulcent and highly esteemed in coughs, etc. The bark is a useful astringent and an infusion is used as a gargle," *Nadkarni*.

Var. **obliqua,** *Willd.* (sp.). This appears scarcely to differ from *C. myxa* except by being pubescent and by the larger fruit. See also under 4.

4. **C. sp.**

A small tree, glabrous or nearly so except the shoots, with

* *N.B.*—Hutchinson (*Kew Bull.*, 1918), restricts *myxa* to the Asia Minor tree with short expanded style arms, and calls the Indian tree *obliqua* which has usually more slender arms.

brown twigs sparingly marked with large lenticels and large ovate leaves 6–8″ long. Leaves nearly smooth above with cystoliths sunk in the surface, base unequal not 3-nerved but with one or two very strong nerves a little above the base and a weaker nerve below them, sec. n. above the sub-basal ones about 4, tertiaries strong scalariform, nervules inconspicuous. Petiole stout ·6–1·2″, lenticellate. Inflorescence not seen.

Santal Parganas!

I am unable to match this tree either in the herbarium or by descriptions. The leaf tip is usually suddenly acute, the margin entire with a marginal nerve only rarely interrupted by the mucronate ending of a nervule. In the *Fl. Ch. Nag.* it was included with the next under *C. obliqua*, but a type leaf of *Willdenow's C. obliqua* at Kew is shallowly cordate, 5-nerved at base with 3 sec. n. above base and tertiary nerves as in *C. myxa*, and nervules very reticulate raised beneath, under-surface uniformly thinly pubescent.

5. **C. sp.** nov.?

This may be the same species as the last, from which it differs very much at first sight by the coarsely crenate-dentate leaves with more acuminate tip. The lenticellate brown twigs and petioles are similar, the base of the leaves sometimes sub-cordate, the venation similar, but the sec. n. all end in a tooth with a mucronate point.

Koderma forests, Hazaribagh!

Neither of these can be considered as varieties of *C. myxa*, and approach more nearly in appearance to *C. grandis*.

6. **C. Macleodii**, *H. f. & T.* Porponda, *Ho.*; Torai-sing, *M.*; Jugia, *S.*; Bharwar, Belwanjan, *Kharw.*; Ghanti, *Or.*; Sambhar-singha (Sambalpur).

A small tree with twigs, leaves beneath, and inflorescence covered with a dense felted white or tawny tomentum. Leaves broadly ovate entire, often deeply cordate, obtuse or very bluntly acuminate, 4–8″ long or sometimes up to 10″, with 3–5 nerves from or from near the base and other venation as in Nos. 4 and 5. Petioles 1·5–3″, much longer in proportion to blade than in last two species. Flowers white in dense tomentose corymbs 2–4″ diam. Young fruit beaked, ripe subglobose, yellowish, somewhat tomentose, apiculate, seated in the broadly campanulate toothed or lobed ribbed or striate calyx.

Central and Southern areas, common on the hills except the coastal regions, whence I have no record of it. Fls. March–April. Fr. May–June. Nearly evergreen. Flowers with the new leaves.

Bark light grey, blaze pale, turning brown. Mature leaves somewhat rugose above and with numerous close cystoliths. Corymbs terminal, often appearing leaf-opposed or extra-axillary. Calyx in flower ·25″, tubular-clavate. Petals ·3″ or less, oblong.

The wood is used for cattle-yokes, axe-handles and agricultural implements. *Gamble* states that it is light brown, beautifully even-grained and very hard.

Var. ?.

Leaves minutely pubescent, not at all tomentose, beneath, more acuminate than in the type and apiculate. Petioles only ·8–1″ long.

Singbhum!

This also might be a separate species, but the inflorescence has not been collected. It differs from 4 and 5 in the want of conspicuous lenticels, in the indumentum, from No. 4 in the shape of the leaves, and from No. 5 in their

being entire; it is also less acuminate than either. The petioles are much shorter than in most *C. Macleodii*, and in many respects it resembles *C. vestita*, *H. f. & T.*, a tree previously only known in the Siwaliks and Lower Western Himalayas.

2. EHRETIA, *L.*

Trees or shrubs, with the blaze (as in *Cordia*) nearly always pale rapidly turning brown on exposure to the air. Flowers small white in axillary or terminal often panicled cymes, rarely solitary. Calyx sub-5-partite. Corolla rotate or sub-salver-shaped, petals 5. Stamens 5 on the tube, anthers ovate or oblong exsert. Ovary 2-celled with terminal 2-fid or 2-partite style and small capitate stigmas. Fruit a drupe with one 4-celled, two 2-celled or four 1-celled pyrenes, cells, or pyrenes sometimes reduced to one by suppression, 1-seeded. Seeds straight, testa thin, albumen scanty.

A. Trees. Fls. cymose and panicled:—
  Leaves serrate . . . . . 1. *acuminata.*
  Leaves entire . . . . . 2. *lævis.*
B. Shrub. Fls. sub-solitary . . . . . 3. *buxifolia.*

1. **E. acuminata,** *Br.* Lahichan, Dantranga (tooth-reddener), *H.*

A small or m.s. tree with elliptic or ell.-oblong, acute or acuminate, sharply serrate leaves 3–5·5″ long with a petiole ·75–1·5″ long. Flowers ·15″ diam. clustered on the branches of dense pyramidal pubescent panicles 3–6″ long. Drupes ·12–·17″ diam., short ellipsoid, with 2 pyrenes, 4-seeded.

Purneah! Fl. March–April. Fr. June–July. More or less deciduous in Dec. or Jan. but flowers with the leaves.

Attains 4 ft. girth with pale-grey flaking bark and hard yellowish blaze in old trees. L. glabrous or minutely hispidulous above, teeth with incurved points when young, sec. n. strong 6–8 forked above and not reaching the margin, other nerves inconspicuous. Calyx ·05″ long, ciliate. Cor.-tube very short, lobes soon reflexed, broadly oblong. Style shortly 2-fid.

This seems to be the "*Ehretia sp.*" to which *Hamilton* applies the above vernacular names and states that it is used for posts, beams and chests. Judging from the name "Dantranga" the bark is chewed as in the next species.

2. **E. lævis,** *Roxb.* Pusi-pan, *S.*; Bhairo, Hardi, *Kharw.*; Chamror, Dantranga, *H.*; Dokke, *Gond.*; Tambalu, Mosonia, *Or.*

A small or m.s. tree with white bark and ovate, broadly or narrowly elliptic or rarely obovate entire leaves usually only 3–4″ at the time of flowering, often attaining 7″ by 4″ when mature, shining above and usually glabrous except for small tufts of hair in the axils of the nerves beneath. Petiole ·5–1·2″ long. Fls. ·3–·4″ diam. in dichotomous scorpioid cymes 2–4″ diam. which are usually borne laterally on the bare branches, more rarely terminal on the young shoots.

Northern Champaran! Purneah, *Hamilton.* Gaya! Throughout Chota Nagpur, usually on river banks! Gangpur! S.P.! Puri! Angul! Kalahandi, along the Tel River, *Grieve.* No doubt therefore in all districts, but nowhere very common. Fl. Feb.–March, or in some forms up to June, with the old falling leaves or when quite leafless or with the young leaves. Fr. usually April–May.

Bark pale grey or white, blaze white with small brown streaks, turning brown. Innovations usually rusty pubescent or tomentose. L. from glabrous, even when young (exc. the nerve axils) to permanently pubescent, sometimes oblique, base usually cuneate on the petiole, apex acute or shortly acutely or obtusely acuminate, sec. n. 5–7 becoming forked and reticulate before reaching the margin. Fls. sessile or pedicelled. Calyx ·05″ long, usually pubescent, with lanceolate or oblong-

lanceolate lobes, scarcely accrescent. Petals ·1″ long, acuminate. Style 2-fid. Drupe black sub-globose ·2–·25″ diam. with 1–4 pyrenes.

The tree is very variable.

Var. **pubescens,** *Clarke.* Branchlets hairy, mature leaves pubescent or hairy. Ramnagar Hills!

"Wood tough and durable. Wt. 35 lbs. Growth 5-8 rings per inch of radius," *Gamble.* It is not much used, but the leaves are used for fodder and the bark is chewed like "pan" and colours the teeth red. The fruit is eaten.

3. **E. buxifolia,** *Roxb.* Syn. E. microphylla, *Lamk.*

A small twiggy shrub 3–4 ft. with small subsessile obovate, mostly fascicled, leaves with entire or strongly crenate margins and rounded apex. Fls. small white campanulate ·25″ diam., solitary or 2-nate on a short axillary peduncle. Drupe ·17–·2″, globose, with one 4-celled and 4-seeded pyrene.

Rocky jungles in the south of the Puri district! Rather rare. Bardwan, "with Carissa bushes," *Burkill!* Fl. Oct.–Dec. Fr. Aug.–Nov.

Twigs strigosely pubescent. L. ·5–1″ often cuneate, hispid or scabrid above and, when dry, marked with large white cystolith-discs at the base of the bristles, solitary or fascicled on abbreviated shoots, pale beneath, narrowed into a very short hispid ·05″ petiole. Fls. 1-sexual, on slender peduncles ·02–·3″, style deeply 2-fid.

3. COLDENIA, *L.*

Prostrate scabrous herbs with alternate crisped leaves and small axillary sessile or subsessile 4–5-merous flowers or the upper sometimes in one-sided spiciform cymes. Corolla-tube broad and short with spreading imbricate lobes. Ovary 2-celled or sub-4-celled. Styles 2 or more or less connate, minutely 2-lobed at apex and again splitting to base in fruit. Fruit nearly dry of 4 sub-connate pyrenes. Testa thin, albumen 0 or scanty, cotyledons flat.

1. **C. procumbens,** *L.*

A much branched herb with prostrate flattened branches, scabrous-hairy, with crisped coarsely serrate or lobulate leaves ·5–1″ long, densely scabrous or hispid on the top. Flowers very small, sessile. Fruit ·15″ pyramidal, of 4 connate 1-seeded pyrenes awned with the hardened style-lobes.

Very common, waste ground, sunny banks, etc.! Probably in all districts. Fl., Fr. Aug.–May. Annual.

Leaves elliptic-obovate, shortly petioled. Fls. scarcely ·2″ diam. Calyx ·1″ long with broadly lanceolate almost free sepals.

4. RHABDIA, *Mart.*

Shrub. Leaves small. Flowers small, 5-merous, terminal or in few-fld. terminal racemes on short lateral branches. Corolla tube campanulate. Ovary 2-celled or sub-4-celled with terminal style and capitate or minutely 2-lobed stigma. Drupe with 4 pyrenes.

1. **R. lycioides,** *Mart.* Tipa, *K.*; Jamchi, Jamoch, *Or.*

A shrub about 2–4 ft. high with tough erect or prostrate branches and linear- or oblong-oblanceolate acute leaves, narrowed at the base, ·5–1·2″ long by about ·2–·35″ broad, appressed hairy shining or almost silvery beneath. Petiole ·05″. Fls. ·25–·4″ diam., pink, on short

pedicels, usually 2–3 at the ends of short lateral branches. Drupe orange-red ·17″.

Rocky river beds. Not very common. Singbhum, both in Saranda and Porahat! Angul, *Lace*! Sambalpur! Fl. Oct.–Jan. Fr. Dec.–Feb.

Branches often rooting, appressed-hairy. L. with 2–4 very faint sec. n. Calyx persistent 5-partite, sepals lanceolate, acuminate. Ovary 2-celled (in our specimens). Ropes are made from the tough split stems.

5. HELIOTROPIUM, *L.*

Herbs or shrubs (not in our area). Flowers small, usually white on the long scorpioid branches of 2-chotomous cymes. Calyx 5-lobed or -partite. Corolla salver-shaped or funnel-shaped, throat not hairy, lobes imbricate or induplicate in bud. Stamens included, anthers ovate or lanceolate. Ovary completely or imperfectly 4-celled. Style terminal, ending in a depressed conical or flat disc or thickening, stigma above the disc 0, or short or elongate, entire or with 2 linear branches. Fruit dry 2–4-lobed or of 4 more or less free nutlets. Seed straight or curved.

I. Calyx campanulate, broader than the corolla, with broadly oblong or sub-ovate sepals enclosing the single large margined nutlet. (Nutlets 2–4 in var. *malabarica*.) . . . 1. *supinum*.

II. Calyx narrow with narrow sepals, not concealing the nutlets:—

A. Leaves large, often 2–4″, ovate. Fruit separating into two 2-seeded pyrenes . . . . . 2. *indicum*.

B. Leaves under 1·5″. Fruit of 4 nutlets:—

1. L. elliptic or obovate, silky. Fls. with a large bract-like sepal . . . . . 3. *ovalifolium*.

2. L. linear or lanceolate, scabrid:—

L. lanceolate. Fls. with conspicuous bracts . . . 4. *marifolium*.

L. linear or linear-lanceolate. Fls. with narrow bracts . 5. *strigosum*.

1. H. supinum, *L.*

Prostrate with numerous stems from the root 6–12″ long, densely softly hirsute or silky throughout. Leaves ·5–·8″ (–1·5″ *Clarke*), elliptic or ovate, obtuse, beautifully silky, with about 4 sec. n. impressed above, prominent beneath, and slender petiole ·15–·4″ long. Fls. white starlike, surrounded by the broad densely hirsute calyx in short softly hirsute spikes ·6–1″ long, without bracts. Calyx ·12–·17″ long with oblong or ovate sepals slightly connate half-way up. Corolla ·1″ diam., tube ·07″, villous outside, throat campanulate, lobes broadly oblong. Anthers large, lanceolate. Stigma above swelling nearly as long as the style. Nutlet in type ovoid strongly margined and somewhat warted, enclosed in the calyx.

Patna! Fl., Fr. Feb.–March, June, Dec. (Perhaps all the year.)

Var. **malabarica,** *Clarke*. Syn. H. malabarica, *Retz*.

Nutlets usually 4 smaller triangular, in horizontal section without margins or sometimes 2 or 3 only and with faint margins.

2. H. indicum, *L.*

A rather coarse herb with ascending hirsute branches and alt. or sometimes subopposite ovate or ovate-oblong leaves usually 2–4″ long, rugose above and with a few hairs, pilose beneath. Flowers lilac, 2-ranked in elongate usually simple bristly ebracteate spikes

2-6″ long. Fruit ·17″ long, 2-lobed, each lobe 4-ribbed with 2 angular "beaked 1-seeded pyrenes which have each an empty cavity on the inner side" (*Cooke*).

Common on railway embankments, roadsides, etc.! Probably throughout the province. Fls., Fr. all seasons.

Spreading 1–2 ft. with usually 2-chotomous branches. Leaves often with cordate base or unequal-sided, margins undulate, sec. n. strong beneath. Petiole ·7-1·5″, more or less winged. Calyx ·1″, thinly bristly. Corolla ·2″ long, funnel-shaped. Anthers ovate. Stigma above the thickening shorter than the style, obtuse.

3. **H. ovalifolium,** *Forsk.*

Usually with an erect central stem and spreading lateral ones, 6–15″ high, with long silky hairs all over but not nearly so densely clothed as in last. Leaves elliptic ·3–1·5″ long or somewhat obovate, contracted at base into a slender petiole ·5–·7″ long. Flowers funnel-shaped ·12″, 2-ranked in dense, finally elongate and somewhat lax spiciform once-forked cymes which appear to be bracteate from one of the sepals being much larger than the others and slightly accrescent in fruit; forks 1·5–3″ long. Bractiform sepal elliptic or ovate, ·12–·2″ long, rest of calyx about ·1″ long only with narrow-elliptic or linear-oblong lobes. Corolla hairy. Anthers linear with connective produced as an acumen. Style hardly any and stigma above the swelling short conical. Nutlets 4, strigosely hairy, ·05″ long.

Frequent, but not often collected! Banks of Ganges, *Kurz*! As it occurs in Darbhanga! Maldah! and the Central Provinces on the hills, it is probably common throughout our area. Many specimens in the Cal. Herb. are marked Bengal without further locality. Fl., Fr. Feb.–May, and Aug. (The only months noted; perhaps all the year.)

4. **H. marifolium,** *Retz.*

Branches many, decumbent from a woody base, appressed-hairy with lanceolate or ovate scabrous leaves ·5–1·25″ long and very short petioles or subsessile. Flowers small white in conspicuously bracteate 2-chotomous rigid spiciform cymes 1–2″ long. Calyx ·15″ long, lobes slightly unequal, lanceolate hairy. Corolla ·2″ long, hairy with ovate lobes and minute teeth between the lobes. Style very short, stigma hardly as long above the prominent thickening, bluntly conical. Nutlets shortly bristly, 4, brown.

Hazaribagh, *Clarke*! Manbhum, *Clarke*! Banks of Soane, *J.D.H.* Behar, *Hope*! Fl., Fr. Oct.–Jan. Perennial.

Forms with narrowly lanceolate leaves are very like *H. strigosum*, but the bracts are ·1″ long. Corolla sometimes ·2″ diam. Fruit densely strigose in some specimens.

5. **H. strigosum,** *Willd.*

Small, with often erect central stem 3–8″ high and many spreading from the root. Stems and leaves with harsh appressed hairs. L. linear or linear-lanceolate, ·2–·7″ long with recurved margins. Flowers white, ·1–·17″ long, sessile or lower pedicelled, 2-ranked in mostly simple spikes 1–2″ long with narrow small bracts. Calyx ·06–·08″ long, strigose, one lobe broadly lanceolate, others narrow-lanceolate. Corolla strigose, tube about as long as calyx, lobes ovate short, plicate in the sinuses between. Anthers minute ovate but

with connective produced into a long acumen. Style minute, swelling large with bluntly conical stigma about as long as the style. Nutlets dark grey-brown, acute, ·06″, hispid above.

Common in dry pastures. Purneah, *Kurz*! Ranchi! Manbhum, *Campbell*! Monghyr; Darbhanga. Fl., Fr. all the year.

6. TRICHODESMA, *Br.*

Coarse hispid herbs with the lower leaves opposite, hairs with usually cystolith-celled bases. Flowers m.s. 5-merous solitary axillary and running into terminal racemiform unilateral cymes. Calyx deeply lobed or partite, lobes accrescent in fruit. Corolla salver-shaped with broad tube or campanulate, throat naked, lobes overlapping to the left, a gland or depression near the base. Stamens with short filaments and lanceolate anthers connivent in a cone, connectives more or less hairy on the back, excurrent, at length twisted. Ovary 4-celled, style terminal, filiform with small stigma. Fruit ellipsoid or pyramidal, finally separating into nutlets closely adnate by their inner face to the 4-winged carpophore or conical torus, sometimes margined.

Ridges from the calyx-sinuses produced downwards into auricles. Corolla over ·6″ diam. with distinct lobes . . . . . 1. *indicum*.
Calyx rounded at the base, without auricles. Corolla under ·6″ diam., lobes not prominent (exc. the twisted tip) . . . . 2. *zeylanicum*.

1. **T. indicum,** *R. Br.* Hetmudia, *S.*; Hetamundia, *Or.*

A much-branched diffuse hispid herb 8–18″ high with sessile usually sub-sagittate or cordate based linear, oblong, lanceolate, or ovate leaves 1·5–4″ long. Flowers blue or violet, or white with brown throat, usually over ·6″ diam. often 1″, in leafy or few-fld. cymes. Calyx ·4–·6″ long, hispid-hairy, lobes lanceolate, margins strongly ribbed and subalate at the connivent bases and produced downwards into a distinct auricle or spur. Cor.-lobes ovate, suddenly narrowed to a fine twisted tip. Nutlets white smooth with polished back, scarcely margined, ·17–·2″ long, ell.-oblong.

Frequent! Behar, *Hope*! Santal P.! Throughout Chota Nagpur ascending to Neterhat, 3000 ft.! Angul, *Chattarjee*! Probably, therefore, in all districts. Fl. Sept.-Jan. and perhaps at other times. Fl., Fr. most of the year. Annual.

Fls. usually nodding, often white or pale mauve. Pedicels lateral or leaf-opposed or extra-axillary often 2″ in fruit. Base of cor.-lobes with brown glands.

2. **T. zeylanicum,** *R. Br.* Same vernacular names.

An erect herb 2–4 ft. high, very bristly below, more hairy towards the inflorescence. Leaves: lower petioled, often oblanceolate and up to 6·5″, upper sessile, oblong or lanceolate-oblong, smaller upwards and passing into bracts. Flowers pale blue, usually about ·4″ diam. only, ultimately very numerous running out into bracteate racemes 2–5″ long, the whole top of the plant becoming a large panicle with leaves at the forks. Calyx with lanceolate or ovate-lanceolate lobes often overtopping the corolla, margins conniving below but marginal ridges not produced at the base into spurs or auricles. Corolla tubular-campanulate with 5 very broad or obovate short lobes with twisted tails, limb sometimes appearing almost truncate except for

the tails. Nutlets ovoid, grey polished outside, brown rough inside, not margined.

Perhaps more common in the western districts than the last! Singbhum, very common! Manbhum, *Ball*! Sambalpur! Kalahandi, *Cooper*! Annual. Fl., Fr. most of the year.

Lower leaves tapering into a petiole ·6″ long (perhaps also in *T. indica*, but lower leaves seldom present when flowering), cauline mostly with a petiole ·1–·2″ long, leaf base not cordate. Pedicels up to 1–1·5″ in fruit. Calyx ·45–·8″ (the latter in fruit), sepals finally spreading in fruit, keeled as in *T. indica*. Cor.-tube ·2–·25″. Ovary hemispheric with position of septa evident as ridges.

7. CYNOGLOSSUM, *L.*

Erect hairy often hispid biennial or perennial herbs. Flowers 5-merous, usually small (very small in our species), blue, or purplish in elongate ebracteate circinate scorpioid cymes. Calyx deeply lobed, spreading in fruit. Corolla subrotate, tube short with 5 scales in the throat. Stamens included, under the scales, anthers small ovate. Ovary lobes 4, style often stout, stigma small. Nutlets 4 forming a depressed pyramid, apices hardly produced above the hilum, bases rounded produced downwards, outer faces convex or flattened, glochidiate, carpophore conic at base, then slender.

Leaves lanceolate or oblanceolate to linear. Nutlets densely glochidiate all round . . . . . 1. *lanceolatum*.

Leaves elliptic to ovate. Nutlets usually sparingly glochidiate on upper face, but with a distinct margin of glochidia . . 2. *denticulatum*.

The key characters are not very satisfactory and they pass somewhat into one another, but I find the character of sessile or pedicelled flowers and the character of the hairs still more difficult to work. *C. micranthum, Desf.*, also, I believe sometimes occurs in the north. It is distinguishable by its very minute nutlets ·05″ long only.

1. C. lanceolatum, *Forsk.*

An erect herb 2–4 ft. high clothed with somewhat hispid, often reflexed, hairs on the stems. Leaves lanceolate or upper linear-lanceolate, radical usually oblanceolate tapering at base into very long slender petioles but often dying when the plant flowers, pubescent. Racemes strigose, branches usually unequal, 3″ and elongate up to 6″ or 1 foot in fruit. Flowers on pedicels about ·1″ long, white with a blueish or purple eye of 5 rays, ·25″ diam. Nutlets ·1″, densely glochidiate all over, sometimes forming an inconspicuous margin with the connate bases of the spines.

Common among grass and in waste places! Fl., Fr. c.s. and h.s.

Rootstock about ·7″ diam. on old plants. Hairs on stems somewhat spreading, scarcely tubercled at base. Radical leaves up to 4·5″ long by 1·3″ wide, tapering into a 6″ long petiole; cauline smaller upwards, attenuate at base with short petiole, villous beneath along midrib and hairy with small tubercled-based and small simple hairs, above with tubercled-based more or less deciduous hairs. Calyx ·1″ long, campanulate in flower, ·15″ in fruit, deeply cleft three-fourths down into ovate-oblong lobes, spreading and often broadly ovate in fruit. Corolla with urceolate tube, lobes suborbicular, throat nearly closed by hooded sulcate pink scales.

2. C. denticulatum, *A.DC.*

A less stout plant than the preceding. Stems much forked with every alternate fork ending in a raceme and finally both forks equal and racemose, hairy with hairs more or less appressed, white, with

small tubercled bases. Radical leaves evanescent at time of flowering, elliptic, 3–4″ by 1·7″, acute or cuneate at base (not long-tapering as in last) with petiole 3–3·5″; cauline leaves often minutely denticulate, hairy, with scattered hairs rising from well-marked tubercled bases above, paler and shortly hairy beneath without tubercles, ovate to broadly lanceolate or elliptic. Racemes strigose, branches usually equal, attaining 6–8″ in fruit. Flowers all pedicelled or upper subsessile, pedicels ·1–·2″ in fruit. Corolla pretty, pale blue with a darker eye ·2–·25″ diam. Nutlets ·1–·15″, the upper face sometimes with only 3–4 glochidia but with a distinct margin of connate glochidia. In other cases, however, there are as many as 12 or more glochidia on the face and the nutlet approaches to that of the last species.

Chota Nagpur, chiefly on the mountains! Fl., Fr. c.s.

The calyx and corolla are much the same size and shape as in the preceding. The two species are not always easily distinguishable and are scarcely more than varieties of one.

8. BOTHRIOSPERMUM, *Bunge.*

Weak herbs with small blue or white pedicelled flowers, lower axillary, upper sometimes becoming racemose in the axils of bracts. Calyx 5-partite, lobes narrow, somewhat accrescent or not in fruit. Corolla-tube short, throat with 5 scales, lobes spreading. Stamens 5 included, anthers ovate. Ovary deeply 4-lobed, style short, stigma capitate. Nutlets 4, ellipsoid, granular scabrid, scar near the middle of inner face, large, hollow, smooth with an inflexed margin, carpophore oblong.

1. **B. tenellum,** *Fisch.*

A weak procumbent and ascending herb with thinly adpressed hairy stems, 7–12″ long, long-petioled elliptic lower leaves about 1·5–2″ long, upper smaller and those on flowering branches (bracts) about ·3″ only, subsessile, with extra-axillary or leaf-opposed small white flowers. Sepals ·05–·06″ in flower, enlarging to ·14″ in fruit, narrowly lanceolate. Nutlets densely minutely tuberculate, oblong, about half as long as the calyx.

Bettiah, *Hieronymus*! Behar, *J.D.H.*! Fl., Fr. Feb.–May.

FAM. 96. CONVOLVULACEÆ.

Herbs or shrubs, very frequently twining to the left, often with milky juice, with alternate leaves, rarely (*Cuscuta*) leafless parasites. Leaves mostly simple and palminerved, sometimes palmately or pinnately compound, very rarely with stipules. Hairs simple or forked. Flowers regular, 2-sexual from minute to very large, solitary or cymose, usually with 2 well-developed bracteoles. Sepals 5 free or connate at the base, imbricate, often very unequal, persistent and sometimes accrescent or winged in fruit. Corolla tubular, salver-shaped, funnel-shaped, campanulate or almost rotate with limb subentire to deeply 5-lobed, lobes in bud rarely imbricate, usually

induplicate-valvate and whole limb plaited. Stamens 5, rarely 4, usually at the base of the tube, sometimes unequal, included or exsert, pollen often with points or prickles. Disc annular entire or lobed or almost obsolete. Ovary superior of 2 (rarely 3–5) carpels, 1- or usually 2- or by the formation of false septa 4-celled, styles 1–2 or almost *nil*, terminal or rarely (*Dichondra*) from between lobes of the ovary, style-lobes or stigmas various. Ovules 2 in each carpel, collateral, erect, basal, sessile, more or less anatropous, micropyle directed down and outwards, integument 1. Fruit various, rarely (*Dichondra*) of nutlets. Seeds 4–1, albumen 0 or scanty, cotyledons foliaceous and plaited; in *Cuscuta* embryo spiral peripheral, cotyledons rudimentary.

Germination usually, or always, epigeal, the expanded cotyledons very frequently retuse or 2-lobed or palminerved.

§ Plants with well-developed leaves. Infrastaminal scales 0 (1–15):—
- I. Ovary deeply divided. Fruit of 2 nutlets:—
  - A small creeping herb . . . . . 1. *Dichondra.*
- II. Ovary entire. Fruit not divided into nutlets (2–15):—
  - A. Style or styles elongate. Petals not lobed (2–14):—
    - 1. Styles 2, or style deeply 2-partite:—
      - Styles 2 undivided, stigmas capitate . . . . 2. *Cressa.*
      - Styles or style-divisions 2-fid, stigmas linear or clavate. Prostrate herb . . . . . 3. *Evolvulus.*
    - 2. Style 1, undivided up to the stigmas:—
      - *a.* Fruit indehiscent; baccate, coriaceous or crustaceous. Sepals often fleshy in fruit or coriaceous, never brittle (4–6):—
        - i. Stigma with linear or oblong lobes. Fruit dry, finally breaking up . . . . . 4. *Rivea.*
        - ii. Stigma with rounded lobes:—
          - Ovary 4-celled. Fruit dry or baccate . . 5. *Argyreia.*
          - Ovary 2-celled. Fruit usually baccate . . 6. *Lettsomia.*
      - *b.* Fruit usually dehiscent with valves, sometimes with very thin pericarp irregularly breaking up, sometimes with exocarp separating from a membranous endocarp. Sepals sometimes dry and brittle when capsule not valvular (7–14):—
        - i. Sepals small, enlarged into wings in fruit:—
          - Climbers with small white flowers (in our species) . . . . . 7. *Porana.*
        - ii. Sepals sometimes slightly accrescent, but not wing-like in fruit. Flowers never very small:—
          - * Stigma with two rounded lobes. Ovary 3-celled in *Ipomœa*, sec. *Pharbitis*, 4-celled in sec. *Batatas*, 2-celled in others (8–11):—
            - ! Corolla tubular or salver-shaped. Stamens exserted (capsule with false partitions between the seeds in 9 and 10):—
              - Corolla tubular from a narrowly-tubular base, orange . . . . . 8. *Mina.*
              - Corolla salver-shaped with very long tube, white or purple. Stems often muricate. 9. *Calonyction.*
              - Corolla salver-shaped with m.s. rather swollen tube, red, yellow or white. Slender herbs, never muricate . . 10. *Quamoclit.*
            - !! Corolla campanulate or funnel-shaped. Stamens included:—
              - Sepals usually similar, not usually herbaceous. Capsule usually valvular, but sometimes irregularly breaking up . 11. *Ipomœa.*

** Stigma with ovate or elongate lobes. Ovary 1-2-celled :—
! Outer sepals different from the inner. Ovary 1-celled . . . . . 12. *Hewittia.*
!! Sepals equal and similar :—
Calyx not supported by two large bracts. Stigmas linear . . . . . 13. *Convolvulus.*
As in *Convolvulus*, but stigmas ovate or lanceolate . . . . . *Jacquemontia* (p. 603).
Calyx supported by two large bracts . 14. *Calystegia.*
B. Style hardly any. Petals lobed or emaginate :—
Climbing shrub with yellowish-white panicled flowers . 15. *Erycibe.*
§§ Twining leafless parasites. Corolla with infrastaminal scales 16. *Cuscuta.*

1. DICHONDRA, *Forst.*

Small prostrate or creeping herbs with roundish stalked leaves and solitary inconspicuous axillary flowers. Sepals nearly free. Corolla broadly campanulate, shorter than the calyx, deeply 5-lobed, almost valvate. Ovary very deeply 2-lobed or almost apocarpous, each lobe 2-celled. Styles 2 from between the lobes, stigmas capitate. Fruit usually of two indehiscent or irregularly dehiscent nutlets. Seeds roundish, smooth.

A genus very close to the Boraginaceæ, but distinguishable from the radicle directed to the inferior micropyle, by the plicate and curved embryo. The habit and indumentum and shape of leaves are also rather those of the Convolvulaceæ.

1. D. repens, *Forst.*

A creeping herb somewhat like a *Hydrocotyle* with orbicular deeply cordate leaves about 1″ diam. Stems and petioles thinly pilose. Leaves glabrous above, pilose on nerves beneath. Petioles slender erect. Flowers campanulate ·1″ long only. Corolla white, tube campanulate nearly as long as the oblong petals. Ovary very minute, villous. Nutlets 2 globose ·07″ diam., mottled brown, far exceeding the styles which become hidden between them. Albumen scanty. Radicle curving over the top of the cotyledons.

A very interesting little plant with a very wide distribution in both hemispheres, but not included in the *Flora of India* (a note states that it was found by *Wallich* beyond Ava). Found in my garden in Ranchi! and probably introduced with plants from Calcutta. Fl., Fr. r.s.

2. CRESSA, *L.*

Dwarf low-lying, much-branched shrubs, usually minutely grey-hairy with small undivided leaves and sessile or very shortly stalked flowers, axillary or in terminal spikes or clusters. Sepals equal, imbricate, unchanged in fruit. Corolla funnel-shaped, deeply 5-lobed, lobes imbricate, not plaited. Stamens exsert. Disc inconspicuous. Ovary more or less 2-celled. Styles 2, stigmas capitate. Capsule 2–4-valved, 4- (usually) 1-seeded. Seed glabrous, cotyledons linear, plicate.

1. C. cretica, *L.*

A small very bushy plant 6–18″ high, grey or hoary. Leaves sessile ·25–·3″, the lower or larger cordate, the upper ovate or lanceolate,

hairy. Flowers small, sessile, numerous, white. Sepals ·12″. Corolla ·17″, lobes reflexed, hairy and bearded. Ovary pubescent at tip. Capsule 4-seeded.

Orissa, near the Chilka Lake, *Prain's Collector*! Fl. r.s.

It looks at first sight very unlike one of the *Convolvulaceæ*. Flowers small, numerous, clustered at the ends of the branches, ·15–·2″ diam. According to *Wight* it grows on salt, and generally flowers during the hot season when the ground about it begins to crack.

3. EVOLVULUS, *L.*

Small prostrate herbs (in our area), sometimes erect or shrubby. Leaves small entire. Flowers small, axillary, single or in a few-fld. inflorescence. Sepals subequal. Corolla limb 5-plaited, subentire. Filaments filiform. Ovary 2–1-celled, styles 2, each cleft into two linear or subclavate stigmas. Fruit a 4–2-valved capsule. Seeds glabrous, cotyledons doubly folded, radicle incumbent.

1. **E. alsinoides,** *L.*

A charming little plant when in flower, reminding one of an English Speedwell. Branches numerous prostrate 4–15″ long, thinly or densely silky. Leaves from linear to usually broadly elliptic ·25–·5″, rarely 1″, densely appressed hairy or silky beneath. Flowers bright blue ·25–·3″ diam., 1–3 terminating slender peduncles which are longer than the leaves, and with 2–3 subulate bracts at the ends. Pedicels usually short or when solitary fls. subsessile on the peduncle. Sepals small lanceolate hairy. Corolla rarely white, subrotate, ·2″ long. Capsule ·12–·14″ diam., thin, 2–4-valved.

In all districts, usually in open pasture land, dry banks, etc. Fl., Fr. July–Dec.

4. RIVEA, *Choisy.*

Erect or twining shrubs with cordate leaves and large flowers mostly in axillary few-fld. cymes and often supported by large bracts at their base. Sepals equal short. Corolla broadly tubular, salver-shaped, or funnel-shaped, scarcely lobed. Stamens included with short filaments sometimes bearded at base. Disc annular. Ovary 4-celled, style slender, stigmas linear or oblong. Fruit baccate or indehiscent and nearly dry, pericarp ultimately irregularly breaking up.

Stout erect (or ultimately scandent). Sepals lanceolate, ·5–·7″ . . . . . 1. *ornata.*
Always scandent, often slender. Sepals ovate, ·3″ . . . 2. *hypocrateriformis.*

1. **R. ornata,** *Choisy,* var. **Griffithii,** *Clark.*

A handsome erect shrub or undershrub, 3–5 ft. high, sometimes said to be scandent though I have not seen it so. Leaves orbicular-cordate, or somewhat reniform, 3–5″ diam., white-silky beneath. Peduncles 3–7-fld. Sepals lanceolate or elliptic-oblong acute, ·5–·75″ long. Corolla-tube 2″ and limb 2″ or more across. Capsule ·7″ diam. yellow-brown usually breaking transversely across, seeds in a white pith.

N. Champaran, frequent! Fl. r.s. Fr. Dec.–Jan. Probably also Purneah.

I have kept no specimens, but the Champaran plant is the same as the erect shrub common in the savannah tracts of the Duars and sent to *Sir D. Brandis*, who

apparently calls it *R. Roxburghii*, *Prain* (*Indian Trees*, p. 484), while *Prain* called it *R. ornata* in *Bengal Plants*! Whether the corolla is glabrous or silky outside I have no note.

2. **R. hypocrateriformis,** *Chois.* Kalmi lata, *Beng.*; Pailwa sag, *Kharw.*

A climber with silky branches, orbicular-cordate leaves 2–3·5″ diam. often broader than long, and white with appressed silky hairs beneath, and long-tubed white flowers 2″ diam. on 1–3-fld. axillary and terminal peduncles. Sepals ovate, or elliptic-oblong and obtuse, ·3–·4″ long. Corolla-tube rather slender dilated upwards, 2″ long, with obliquely spreading limb 1·3″ long with well-marked bands on the corolla. Fruit globose ·5″ diam.

Behar, *J.D.H.*! Scrub jungles in Singbhum, not common! Hazaribagh (Koderma forest)! Palamau! Ranchi, *Clarke*! Santal Parg.! Fl. Sept. Fr. Nov.–Dec.

Leaves with rounded or short-cuspidate tip, not thickly tomentose, lateral nerves about 4, of which 3 are from close to base, petiole 1–2·5″ or about as long as their leaves. Corolla limb glabrous or puberulous without. Capsule seated on the 1″ diam. calyx, when breaking up usually leaving the four vascular bundles marking the margins of the septa.

The leaves are said to be eaten in Palamau.

5. ARGYREIA, *Lour.*

Climbing rarely erect shrubs with usually silky hirsute or pubescent leaves and penninerved, but with several lateral nerves close to the base. From *Rivea* it differs chiefly in the more or less globose stigmatic lobes. Sepals equal or unequal, seldom accrescent. Corolla funnel-shaped, 5-angled or -lobed. Filaments often wider at base. Fruit baccate to dry and hard, indehiscent.

I. Cymes mostly sub-capitate or very dense. Sepals ovate to oblong, finally coriaceous :—
  A. Leaves broadly ovate-cordate :—
    1. Peduncles very long and stout :—
      Bracts caducous. L. silvery tomentose beneath, glabrous above . . . . . 1. *speciosa.*
      Bracts persistent, orbicular. L. appressed-hairy beneath, hairy above . . . . . 2. *cymosa.*
    2. Peduncles short, sometimes only 1-fld. :—
      Bracts sub-persistent, narrow-elliptic. L. appressed-hairy beneath, hairy above. Fruit succulent . . . 3. *Roxburghii.*
  B. Leaves narrowly ovate or ovate-oblong . . . . . 4. *Daltoni.*
II. Peduncles 1-3-fld. Sepals finally much enlarged, orbicular, fleshy when fresh . . . . . 5. *tiliæfolia.*

1. **A. speciosa,** *Sweet.* Bich-tarak, guguli, *Beng.*; Samandar-sok, *H.*; Munda noi, *Or.*; The Elephant Creeper.

A stout handsome climber with woody stems often ·5″ diam., new shoots densely white tomentose. Leaves 6–12″ diam. beautifully white silvery silky beneath, but above quite glabrous even when young. Flowers 2–3″ diam., white woolly outside, bright purple or rose within, in very long-peduncled many-fld. sub-capitate cymes with large ovate-lanceolate acute thin softly woolly deciduous bracts, ·5–1·5″ long. Fruiting sepals leathery ·5–·6″ long, fruits like broad acorns ·6″ diam.

Wild in Orissa. Puri district! Elsewhere only cultivated. Fl. r.s. and c.s. Fr. Jan.–April. Leaves renewed in April.

L. broadly ovate cordate with about 14 strong sec. n., of which some 6 are close to the base each side, impressed above, apex rounded or acute with excurrent midrib. Petiole 3–9″, always shorter than the blade. Peduncles 5–9″, stout, white tomentose. Flowers 2–3″ long, corolla tubular-funnel-shaped, with the longitudinal lanceolate bands silky. Outer bracts acuminate.

2. **A. cymosa,** *Wight.*

A somewhat far-spreading climber with sub-strigosely hairy stems, orbicular cordate acute or very shortly cuspidate leaves 3–5″, softly appressed-hairy beneath and with shorter hairs above. Flowers white and rose-coloured in long-peduncled capitate, 2–3-chotomous cymes 1–2″ diam. Corolla 2–2·5″ tubular-funnel-shaped. Berry ·75″.

Puri jungles, common! Fl. Nov.–Dec. Fr. Feb.

L. with 7–8 sec. n. of which 2–3 near the base. Petiole 1·5–2·5″. Cymes *scented* on peduncles 3–6″ or rarely 8″ long, pubescent. Bracts persistent, tomentose-hairy ·4″ orbicular-cuspidate foliaceous or sometimes lower larger and just like small leaves. Fls. subsessile, sepals purplish, outer like the bracts ·5–·6″ with very broad base, inner two narrow oblong. Corolla densely silky on the bands.

3. **A. Roxburghii,** *Chois.*

A rather robust twiner hirsute with spreading and reflexed hairs on the stem, broadly cordate leaves hairy with appressed fulvous hairs beneath and with shorter hairs above, larger about 6 × 5·5″ with shortly suddenly acuminate apex. Flowers funnel-shaped 2–2·5″ long in very short and few-flowered cymes ·75–2″ long only (without the flowers) including the peduncles. Fruits orange fleshy depressed-globose ·75–1·1″ diam. Fruiting sepals slightly fleshy broadly ovate and only ·25–·4″ long in quite ripe fruits owing to the outer non-fleshy portions drying off.

Northern area only. Purneah, common! Fl. Aug.–Sept. Fr. Nov.–Dec.

Sec. n. about 10 of which 3–4 close to base. Petiole 1·5–4″. The very short peduncles are very constant in our area though more eastern examples have them longer. Bracts sub-persistent ·5″ narrow elliptic densely strigosely hairy, some foliaceous 1·2–1·5″ elliptic and acuminate. Flowers sometimes sub-solitary. Sepals ·3–·5″. Corolla with a few adpressed hairs on the lanceolate bands. Seeds 1–4, ·3–·35″ oblong rounded scarcely compressed on two inner faces even in 4-seeded fruits.

4. **A. Daltoni,** *Clarke.*

A large handsome climber with strigosely-hairy or -pubescent stems, large narrowly ovate or ovate-oblong, shallowly cordate-based leaves reaching 8·5–9″ by 4–5″ with gradually tapering apex, thinly strigose with pulvous hairs beneath. Flowers bright red-purple 2·5″ diam. with tube 1·5″ long in 3–7-fld. cymes with persistent bracts, on stout peduncles 1–5″ long.

Mountains in Singbhum! Angul! Fl. Sept.–Oct. Fr. Jan.–Feb.

Base of leaves sometimes rounded and not cordate, sec. n. 6–7 only, petiole 1–2″. Cymes rather dense with foliaceous spathulate or linear-oblanceolate bracts ·5–·8″ long, very persistent (even after the fruit has fallen). Pedicels short. Sepals ·5–·6″ outer oblong, inner smaller lanceolate silky. Corolla tube with long soft hairs outside. Berry ·7″ diam.

5. **A. tiliæfolia,** *Wight.* Syn. Convolvulus gangeticus, *Roxb.*; Stictocardia tiliæfolia, *Hallier.*

A dense twining shrub with large suborbicular or ovate deeply

cordate leaves 2–4″ long with a thin white tomentum beneath. Flowers 2·5–3″ white with red centre, or rose-purple (*F.B.I.*), or pink (*Roxb.*), 1–3 on a peduncle ·5–3″ long. Calyx ·4–·6″ in flower. Fruit thin dry 1–1·5″ diam including the accrescent fleshy calyx which is 1·2–1·6″ long in which it is completely enclosed. The calyx with age becomes a network of veins from which the intermediate tissue sometimes disappears.

Tidal Forests. Probably occurs in the Mahanadi delta. Fl. Dec.–Jan.

6. LETTSOMIA, *Roxb.*

Distinguished from *Rivea* and *Argyreia* only through the 2-celled ovary. Sepals nearly equal, usually only slightly accrescent. Corolla from small to large, mostly shortly lobed. Anthers seldom exsert. Disc anular. Style elongate, slender, stigma of two rounded lobes. Fruit baccate, indehiscent, sometimes dry, 4–1-seeded.

A. Stamens exserted. Flowers ·5–·6″ long:—
  Bracts obovate or orbicular, woolly, persistent . . . . . 1. *aggregata.*
  Bracts subspathulate or oblong, deciduous . . . . . 2. *bella.*
B. Stamens included. Flowers large, 1·5–2″:—
  L. ovate-lanceolate gradually acuminate. Peduncles slender, not exceeding the petiole . . . . . 3. *Thomsoni.*
  L. broadly ovate, caudate. Hairs patent or subpatent. . . . 4. *strigosa.*
  L. lower broadly ovate, upper sometimes ovate-lanceolate. Peduncles exceeding the petioles. Hairs strigose . . . 5. *setosa.*

1. L. aggregata, *Roxb.*

A pretty climber, resembling in new leaf *Argyreia speciosa*, with milky juice, white tomentose shoots, ovate cordate leaves 3–5″ at time of flowering, attaining 6·5″ when mature, white tomentosely hairy beneath, appressed hairy or pilose above. Flowers pink campanulate with spreading petals, ·5–·6″ long only in peduncled capitate cymes with broadly obovate or orbicular woody subpersistent bracts resembling the outer sepals. Berry red, fleshy ·3″.

Southern tract only, Puri! frequent. Fl. Sept.–Dec. Fr. Dec.–April. The new leaves appear in April.

L. mostly obtuse or rounded at apex, sec. n. 10–12 of which 3–4 near base, petiole 1–5″. Peduncles ·2–4″ tomentose numerous. Two outer sepals concealing the rest woolly or in fruit hirsute, ·35–·4″, inner oblong silky ·3″. Corolla white-hirsute on the lanceolate bands. Stamens far exserted. Berry ultimately dry with thin epicarp and membranous endocarp sometimes intruded between the seeds, seated on the persistent calyx which is scarlet within. Seeds ·17″ grey minutely woolly round the large areole.

Note.—The type has leaves glabrous above. Our species seem always to be var. *osyrensis, Clarke.*

2. L. bella, *Clarke.*

A pretty climber closely resembling the last, than which it is little more than a variety. Juice milky, stems white tomentose. L. 4-6″, densely pilosely or silkily tomentose beneath and with silky adpressed hairs or glabrous above. Bracts ·2–·25″ subspathulate or oblong deciduous.

Singbhum, often in grassy glades! Palamau, very common in the Southern Range! Ranchi ghats! Probably in all districts of Chota Nagpur, doubtfully extending into Orissa, although there appears to be a specimen from Ganjam, *Gamble*! and Angul, *Lace*!

Sec. n. 9–10, lowest 3–4 close to base. Petiole 1–3·5″ Peduncles ·5–3″. Calyx

·4–·5″ densely appressed hairy or hirsute, sepals oblong, 3 outer larger. Corolla ·6–·7″ long by ·8″ diam. with white tube and spreading pink limb, anthers exserted pink. Fr. dry when ripe as in last, ·3″ diam. scarlet. Seeds brown.

A very luxuriant form is found in Palamau with leaves attaining 11 by 9·5″ with petiole 3–8″.

3. **L. Thomsoni,** *Clarke.*

A robust climber with hairy (not strigose) stems, ovate-lanceolate gradually acuminate leaves 4–6″ long with cordate or shallowly cordate base, thinly setosely hairy both sides. Fls. 1·5–2″ long and 1·5″ diam., purple, in peduncled capitate cymes with the peduncles mostly as long as the petioles. Bracts oblanceolate or spathulate-oblong ·3–·5″ long, deciduous, much less hairy than the densely fulvous-hirsute sepals, the hairs of which entirely conceal them. Fruit dry 2–4-seeded, ·3–·4″ diam.

N. Champaran, Ramnagar Hills! Fl. Oct.–Nov. Fr. Jan.

L. with about 10–12 sec. n. of which 3 close to the base, petiole 2–3·5″ long, hairy. Cymes about 1″ diam. Peduncles 2–4″. Corolla with fulvous hairs on the lanceolate bands.

4. **L. strigosa,** *Roxb.*

Habit of the last which it somewhat resembles but that the leaves are broadly ovate and suddenly acuminate or caudate, more densely hairy (scarcely strigose) on both surfaces, sec. n. 12–16. Peduncles often 6″. Bracts larger, 1″, elliptic-oblong, sub-foliaceous, persistent.

Sikkim Tarai, close to Purneah, and will probably be found in Purneah. Fl. r.s.

The brownish hairs which copiously cover the plant are spreading on the branches, petioles and peduncles and long, scarcely appressed, on the leaf blades, so that the name "*strigosa*" is not an applicable one.

5. **L. setosa,** *Roxb.* Baghchaur, *Gond.*

A large handsome climber with milky juice. Stems and leaves beneath with adpressed setose hairs. L. broadly ovate or oblong-ovate, cordate, obtuse or acute or shortly cuspidate, 4–6″ long and broad, upper sometimes ovate-lanceolate. Flowers 1·5–2″ long, tubular-funnel-shaped, usually with white tube somewhat ventricose in middle and a purple limb, 1–1·3″ diam. in dense stout corymbiform cymes 2–5″ diam. on long stout strigose peduncles 3–9″ long. Bracts broadly elliptic or orbicular-oblong, coriaceous, ·3″, densely strigose, deciduous in fruit. Berries yellow to bright orange, ·3″ diam.

Widely distributed. Champaran! Ranchi (Biru), *Cardon*! Singbhum! Palamau, ascending to Neterhat 3000 ft.! Manbhum, *Kurz*! Puri, *Lace*! Angul! Sambalpur! Kalahandi, *Cooper*! Fl. Oct.–Nov. Fr. Nov.–Jan.

Leaves sometimes sparsely setose above, the hairs leaving minute dots after falling, sec. n. 8–13 of which 3–4 are close to base. Petiole 1–5″ strigose. Cymes with main branches 2–3-chasial, flowers sessile at the angles of the ultimate branches. Bracts leaving persistent scars on the cymes. Sepals ·3–·5″ broadly oblong or 3 outer or all orbicular, thick, concave, somewhat fleshy and accrescent in fruit which they enclose till quite ripe, then spread and become coriaceous or woody. Corolla strigose on the white bands. Berry depressed-globose, succulent, 4–2-seeded.

NOTE.—The specific name "*strigosa*" suits this plant much better than the one to which it is applied and the names would have been better interchanged.

7. PORANA, *Burm.*

Scrambling or twining shrubs with usually cordate leaves and small or m.s. flowers axillary and in copious panicles. Sepals at first

equal and small, very accrescent in fruit, developing into large veined wings. Corolla usually small, campanulate or somewhat funnel-shaped or salver-shaped with broad-lobed spreading limb. Fil. slender, anthers linear to lanceolate. Disc anular or 0. Ovary 2-celled, with 2–4 ovules. Fruit small 1-seeded, usually finally 2-valved. Seeds smooth.

1. **P. paniculata,** *Roxb.* Era-bair, *K.*; Panjot-nari, *S.*; Bhudia-lar, *Kharw.*; The Bridal Creeper.

A beautiful climber forming large pure white patches in the jungle with its innumerable, panicled, small white flowers, and softly white-tomentose ovate-cordate leaves.

Ramnagar Hills, common! Rajmahal Hills, common! Stony nalas, banks, and northern sides of hills and ghats, throughout Chota Nagpur! Fl. Oct.–Dec. Fr. Jan.

Shoots tomentose. L. 1″ by ·5″ to 5″ by 3″, rarely lower leaves 6″ diam., acute or acuminate, base 5–6-nerved. Calyx in fl. ·05″ long. Corolla ·25–·3″ long tubular-funnel-shaped. Fruiting sepals all equally enlarged or sometimes three ·75 by ·25″ and two linear only ·25″ long. Capsule membranous globose hairy or tomentose ·2″ diam.

8. MINA, *Llave et Lex.*

Flowers with a very short corolla from which the stamens and style are far exserted and somewhat declinate. Calyx very short, sepals equal. Corolla with a very short tubular basal portion and a wider tubular-campanulate longer upper 5-lobed portion.

1. **M. lobata,** *L. & L.*

A climber very commonly grown in gardens with dichasial cymes of orange and scarlet flowers in elongate dichasial racemiform cymes. Leaves palmately lobed.

9. CALONYCTION, *Choisy.*

Twining, large often muricate or prickly herbs with simple cordate leaves and very large white or purple flowers in axillary few-fld. dichasial cymes, rarely solitary. Corolla salver-shaped with very long narrow cylindrical tube and a broad spreading scarcely lobed margin. Stamens exsert, sometimes very slightly. Stigma with 2 rounded lobes. Fruit mod.-sized, 2-celled but often with false dissepiments between the seeds.

Flowers white. Pedicel not usually clavate in fruit	1. *bona-nox.*
Flowers purple. Pedicel very clavate in fruit	2. *muricata.*

1. **I. bona-nox,** *Boj.*, var. grandiflora. Syn. Ipomæa Bona-nox, *L.*; C. speciosum, *Choisy*; Ipomæa grandiflora, *Roxb.*; Dudhia-kalmi, halkalmi, *Beng.*; Kunja-lata, *Or.*; Moon-flower.

A large glabrous twiner with the stems sometimes muricate. Leaves broadly ovate cordate acute or acuminate with petioles about as long as the blades. Flowers 3–5″ diam., pure white or with greenish plaits on 1–5-fld. peduncles 2–6″ long; pedicels short, sometimes wider upwards but not greatly thickened in fruit. Capsule 1″ ovoid oblong. Seeds glabrous.

Wild in Northern Purneah and the Mals of Orissa! Frequently cultivated for the large beautiful fragrant flowers which open of an evening and close the following morning. Fl. r.s. and up to Dec.

Leaves with deep sinus and rounded basal lobes, otherwise entire and not lobed, tip sometimes shortly caudate. Calyx ·4–·5″, sepals with mucronate or cuspidate tips, not or scarcely enlarged in fruit. Corolla-tube 2·5–3″.

2. **C. muricatum,** *G. Don.* Syn. Ipomœa muricata, *Jacq.*

A less robust climber with the stems muricate with soft prickles, leaves glabrous 3–5″ or sometimes 6″, broadly ovate cordate ending in a long acumen or shortly caudate or acute. Flowers pale pink or purple sometimes only 3–4 racemiform on a peduncle or more cymose, often appearing spicate in fruit from the extraordinary development of the pedicel which is thickly clavate for its whole 1·25–1·5″ length and looks like a large inferior ovary. Sepals ·5″ ending in a long cusp or acumen, keeled. Corolla-tube 1–2″ long by ·2″ long, limb about 1″ long. Young fruit often pink. Capsule ·5–·7″ diam. globose, apiculate. Seeds smooth.

N. Champaran! Hazaribagh! Palamau, common! But nearly always near villages. Fl., Fr. Sept.–Dec.

10. QUAMOCLIT, *Tournef.*

Twining herbs with simple cordate or lobed or, rarely, pinnate leaves and usually showy funnel-shaped or sub-salver-shaped (with weakly funnel-shaped tube) flowers in axillary long-peduncled umbellate cymes. Sepals equal, usually with cuspidate tips. Corolla-tube broader upwards often constricted under the spreading limb. Stamens exsert. Ovary and fruit 4-celled by false dissepiments between the seeds. The rest as in *Ipomœa.*

L. simple ovate cordate . . . . . 1. *coccinea.*
L. pinnate with filiform segments . . . . . 2. *vulgaris.*

1. **Q. coccinea,** *Moench.* Syn. Ipomœa coccinea, *L.*; Quamoclit phœnicea, *Choisy.*

A slender herbaceous climber with broadly ovate cordate leaves 1·5–2·5″ long and few-flowered long-peduncled cymes of usually deep crimson very pretty flowers with the narrowly funnel-shaped tube, 1–1·2″ long and limb about ·7–·9″ diam.; sometimes yellow or orange flowers are found.

More or less naturalised throughout the province. Very common in gardens. Fl., Fr. r.s. and c.s.

Stems and branches puberulous or somewhat hispidulous. Leaves glabrous, tip usually rounded. Calyx ·15–·2″ including the long subulate tips of the sepals. Ovary 4-celled. Capsule ·25–·27″, ovoid with membranous septa.

2. **Q. vulgaris,** *Choisy.* Syn. Ipomœa Quamoclit, *L.*; Q. pinnata, *Boj.*

A very graceful slender climber with pinnate leaves 2–5″ long with numerous filiform segments and brilliant crimson, or sometimes white, flowers of about the same size and shape as the last.

Very common in gardens and also often self-sown. Fl., Fr. chiefly r.s.
Both species are natives of Tropical America.

11. IPOMŒA, *L.*

Twining, more rarely prostrate, rarely erect herbs or shrubs with simple entire or lobed usually cordate-based or sometimes palmately compound leaves. Flowers often showy; solitary or cymose. Sepals

equal or unequal, often coriaceous or membranous, mostly short, sometimes accrescent in fruit and often becoming foliaceous papery or brittle but not thick and fleshy nor enclosing the fruit. Corolla campanulate or funnel-shaped, entire or slightly lobed with the vertical bands (which are the portions outermost in bud) usually well marked by their slightly different texture or venation. Stamens included, filaments often hairy or dilated at base, often unequal, pollen spinulose or echinulate or (*Merremia*, etc., of some authors) smooth or banded. Anthers ovate to linear, sometimes twisted. Disc annular, often lobed. Ovary 2-, rarely 3- (*Pharbitis*) or 4- (*Batatas*) celled, ovules 4. Stigma of two globose lobes. Capsule coriaceous or membranous or brittle, usually 4-valved. Seeds 4 or fewer. Cotyledons broad, plicate, often 2-lobed.

Ipomœa of *Linnæus* and in the *Fl. Brit. India* includes the groups sometimes distinguished as genera under the names of *Calonyction*, *Mina*, *Quamoclit*, *Pharbitis*, *Operculina*, *Aniseia* and *Merremia*. The separation of the last two (by *Hallier, f.*) appears to me especially artificial, and is based on the character of the extine of the pollen (whether smooth or echinulate) unsupported by other characters (I find the character of 2 or more lines, etc., in the bands unworkable), and separates obviously allied species. *Operculina* has been separated by the supposedly circumsciss exocarp. This distinction is based on too few observations, as the exocarp of *Ipomœa* (*Operculina*) *turpethum* sometimes splits longitudinally into 4 valves. *Pharbitis* and *Batatas* may be more natural, but these were not separated by *Hallier*. I therefore include all the genera *Pharbitis*, *Batatas*, *Operculina*, *Aniseia* and *Merremia* in *Ipomœa*, and separate therefrom only *Calonyction*, *Mina* and *Quamoclit*, which are easily distinguishable in our species.

I. Ovary 2-celled (Spp. 1–24):—
  A. Sepals green herbaceous, usually hairy (Spp. 1–7, see also 19 and 21):—
    1. Outer 2–3 sepals much larger than the inner, accrescent. (Small plants with undivided leaves under 3″ and peduncles often 1-fld. and 2-bracteate, fls. under 2″):—
      Glabrescent. Sepals decurrent at base in fruit (*Aniseia*) . . . . . 1. *uniflora.*
      Hirsute. Sepals lanceolate. L. ovate-oblong . . 2. *barlerioides.*
      Villous. Sepals cordate or sagittate, not decurrent, leaves ovate cordate . . . . . 3. *calycina.*
    2. Sepals equal or nearly so, scarcely accrescent. (Usually weak twiners with very hairy calyx):—
      a. Flowers pink in bracteate heads:—
        i. Leaves entire (see also *I. pes-tigridis*, var.):—
          Heads sessile or sub-sessile. Fls. small . . 4. *hispida.*
          Heads long-peduncled with a large 2-cuspidate bract . . . . . 5. *involucrata.*
        ii. Leaves deeply lobed (entire in one var.). Hds. long-petioled, many-bracteate . . . . . 6. *pes-tigridis.*
      b. Fls. in lax persistently bracteate 2-3-fld. cymes:—
        Leaves white beneath, often 3-lobed . . . . 7. *pilosa.*
  B. Sepals dry, membranous or somewhat fleshy with scarious margins, not hairy (hairy in 21, ciliate in 11, pubescent in 13 and 19). Spp. 8–24:—
    1. Leaves not deeply palmately lobed or only 2-3-lobed:—
      a. Small plants, never widely scandent. Fls. under 1″, usually yellow or white:—
        i. Sepals glabrous (*Merremia*):—
          * Leaves longer than broad, usually oblong:—
            Prostrate. L. sessile, often hastate, rarely 1″. Fls. ·3″ . . . . . 8. *tridentata.*

Twining. L. similar but larger. Fls. ·75″ 9. *hastata.*
Prostrate or twining. L. petioled. Fls. ·7″ . . . . . 10. *cæspitosa.*
** Leaves nearly or quite as broad as long:—
Stem creeping. L. reniform. Fls. ·5–·75″, sepals ciliate . . . . . 11. *reniformis.*
Twining. L. often 3-lobed, ovate cordate. Fls. ·7″, in 3-7-fld. cymes, sepals glabrous . . . . . 12. *chryseides.*
ii. Sepals pubescent (*Ipomœa*):—
Twining. L. ovate or suborbicular, cordate, entire . . . . . 13. *obscura.*
b. Flowers over 1″, rarely yellow (*Ipomœa, Merremia* and *Operculina*). Spp. 14–20:—
i. Peduncles 1-fld., more rarely 2-3-fld., often 2-bracteate. Never widely scandent:—
* Creeping, prostrate or floating:—
Aquatic. L. mostly narrow . . . 14. *reptans.*
Littoral. L. orbicular 2-lobed or emarginate . . . . . 15. *pes-capræ.*
** Prostrate or twining from a woody stock:—
Glabrous. L. oblong to linear. Corolla hirsute, sometimes yellow . . . 18. var. *pauciflora.*
Pubescent. L. ovate to oblong-lanc. Corolla glandular . . . . . 19. var. *humilior.*
ii. Peduncles usually several-many fld. Climbers:—
* Calyx glabrous, without external glands:—
! Herbaceous. Leaves under 3″:—
L. cordate-ovate 1–2″, sometimes sub-3-lobed. Fls. purple or white, sepals ·2–·3″ ovate-oblong. Corolla glabrous . . . . . 16. *sepiaria.*
L. oblong, ell. or lanceolate, often cordate or hastate. Fls. white or cream. Sepals ·3–·35″ ell. obtuse and apiculate. Corolla pubescent at tip . 17. *cymosa.*
!! Shrubby. Leaves over 3″ long:—
L. broadly ovate or ovate-oblong. Calyx ·3–·35″. Corolla pubescent at tip only . . . . . 17. *cymosa*, var.
Stems often sub-alate. Calyx ·6–·8″. Corolla hirsute . . . . . 18. *petaloidea.*
** Calyx pubescent. Outer sepals much larger than the inner, accrescent:—
Stems usually 3–4-alate. Calyx ·7–1″. Corolla gland-dotted, otherwise glabrous . . . . . 19. *turpethum.*
*** Calyx with outer sepals 2-glandular, ·25″:—
L. ovate-cordate acuminate. Corolla large, pink, puberulous . . . . . 20. *carnea.*
2. Leaves deeply 5–7-lobed or palmately compound:—
a. Sepals hairy, ·5″ accrescent. Corolla yellow, 2″ . 21. *vitifolia.*
b. Sepals glabrous:—
i. Leaves simple lobed. Exotics:—
Lobes of leaf elliptic or lanceolate, subentire . 22. *palmata.*
Lobes of leaf again lobed or pinnatifid . . 23. *sinuata.*
ii. Leaves digitate palmately compound. Fls. white . . . . . 24. *quinata.*
II. Ovary 3-celled, ovules 6 (*Pharbitis*):—
Leaves 3-lobed, hairy. Flowers blue or pink . . . 25. *hederacea.*
III. Ovary 4-celled. Ovules 4 (*Batatas*):—
Scandent. Leaves deeply palmately lobed . . . . 26. *digitata.*
Prostrate. Leaves triangular or irregularly sharply lobed. Cultivated herb with tuberous roots . . . . . 27. *batatas.*

Several other species are often found in gardens, such as the Morning Glory

(*I. purpurea*), an annual tropical American species usually called *Convolvulus major* by horticulturalists, and the beautiful blue perennial *I. Learii*, etc.

1. **I. uniflora,** *Roem.* Syn. Aniseia uniflora, *Chois.*

A creeping and twining herb with glabrescent stems, oblong, obtuse or emarginate, mucronate leaves 1·5–3·5″ long mostly with slender ·3–·5″ long petioles and solitary campanulate white flowers ·8–1″ long. Sepals in flower ·4–·5″, fruiting reticulate-venous, ·6–·75″ and somewhat decurrent on the pedicel, two outer ovate subcordate scarious. Corolla rather densely hairy. Capsule ovoid glabrous ·5″.

Usually found near jheels! Chota Nagpur, *Beng. Plants;* but I can find no specimens from Chota Nagpur either at Calcutta or Kew.

Leaves with usually cuneate base. Peduncle with pedicel 1·5-2″ long with a pair of minute persistent bracts. Corolla-lobes short acute.

The pollen of this species is quite smooth, for which reason it has been placed in a separate genus *Aniseia* by many botanists. It appears to me to be too close to the two next to thus separate it.

2. **I. barlerioides,** *Benth.*

A trailing herb or ultimately twining with hirsute or hairy stems, ovate-oblong leaves 1–2″ (–3″ Clarke) long with shallowly cordate base and rounded, rarely acute, often mucronate apex. Flowers light-purple about 1·7″ long and 1·25–1·5″ diam. on axillary bracteate 1- (rarely 2-) fld. peduncles. Calyx hairy with 2 outer large leafy ovate-lanceolate or lanceolate sepals ·55–·7″ long and 3 inner much narrower linear sepals, but nearly as long in flower.

Usually in grass. Ranchi and Palamau, on the tops of the *pats*! Manbhum, *Camp.*! Hazaribagh, *Clarke*! Fl. May–Oct.

Branches annual from a woody stock. Leaves hairy especially on the nerves beneath, sec. n. 3-5, of which 1-3 from the base each side. Petiole ·15–·25″ long. Peduncles at first very short and about as long as petiole, soon elongating and sometimes attaining 3″ in fruit, hairy, with two hairy lanceolate or ovate-lanceolate bracts towards the end ·3–·5″ long. Pedicel very short. Corolla funnel-shaped from a basal very narrow tubular portion, bands well-marked when fresh, about 5-7-nerved. Fruiting sepals nearly 1″ long. Capsule ·5″ ovoid, glabrous. "Seeds oblong, villous or pubescent" (*Clarke*).

3. **I. calycina,** *Benth.*

Slender, twining, hairy or villous with ovate and usually deeply cordate, rarely oblong or shallowly cordate, leaves 1–3″ long, acuminate or acute, usually sparsely hairy. Flowers white or rose, solitary or in lax few-fld. cymes, rather small, ·5–·75″ rarely 1″ long. Pedicels with a pair of narrow-lanceolate bracts at base. Calyx ·35″ in flower, ·5″ in fruit, cordate or hastate. Corolla funnel-shaped. Capsule ·3–·4″ ovoid, glabrous. Seeds villous, margins with long silky hairs.

Ranchi, *Clarke*! Rare. Fl., Fr. r.s.–Oct.

4. **I. hispida,** *Roem.* Syn. I. eriocarpa, *R. Br.*; Convolvulus hispidus, *Vahl.*

A slender very hairy twiner with narrowly lanceolate to deltoid or ovate acuminate cordate-based leaves 2–3″ long, or upper smaller. Flowers very small pink or purple, campanulate or urceolate, in sessile or subsessile capitate axillary cymes about ·5–·75″ diam. Capsule 2–4-valved globose hairy ·25″ diam., 2-celled, 4-seeded.

Not uncommon in open jungle and Arhar fields. Singbhum! Hazaribagh! Palamau, *Gamble*! Annual. Fl. r.s. Fr. Sept.–Nov.

L. with about 5–6 sec. n. of which 2–3 from the base, hairy or somewhat glabrescent. Petiole slender, 1–2″ long with reflexed hairs. Cymes sometimes with a peduncle ·3–·5″ long, hirsute. Pedicels very short, bracteolate. Sepals very imbricate, two outer nearly enclosing the others, orbicular with a long spreading acumen or cusp. Corolla ·5″ long pubescent, lobes acute. Seeds glabrous or puberulous, grey.

5. **I. involucrata,** *Beauv.* Syn. I. pileata, *Roxb.*

A slender twiner with patently hairy stems and hairy broadly ovate deeply cordate petioled leaves 2–3″ long and broad, and flower-heads remarkable for their broad entire boat-shaped involucre consisting of one bract (or perhaps two connate bracts) cuspidate each end. Fls. pale pink.

Northern Bengal (without precise locality), *Cal. Herb.*! Fl. Oct.

It somewhat resembles the entire-leaved form of *I. pes-tigridis.*

6. **I. pes-tigridis,** *L.* Languli-lata, *Beng.*

A rather slender twiner, fulvous hairy or hirsute all over with spreading hairs and deeply palmately 5-9-lobed leaves 2–5″ diam., with lanceolate or elliptic acute or acuminate lobes contracted at the base. Flowers 1–1·25″ in long-peduncled heads with persistent long bracts. Corolla pink funnel-shaped with spreading limb. Capsule ·25″ ovoid, papery, glabrous. Seeds minutely velvety or nearly glabrous.

Banks of fields, waste ground, etc., in all districts, common. Fl., Fr. r.s.

Petiole 1–2″. Peduncles 2–4″, rarely only ·5″ (*F.B.I.*). Heads dense. Outer bracts ovate or elliptic, ·7–1″, inner smaller, narrower, acute. Sepals ·3–·5″, lanceolate, hardly accrescent in fruit.

Var. **capitellata,** *Clarke.*

The leaves are ovate-cordate, acute, entire.

Extends to Bihar, *C. B. Clarke.* I have not met with it.

7. **I. pilosa,** *Sweet.*

A m.s. very hairy twiner with spreading somewhat swollen-based hairs on stems, petioles and cymes. Leaves 2–6″ ovate cordate with sometimes also two lateral triangular lobes, white cottony tomentose beneath and with hairs on the nerves, hairy above. Flowers about 1″ long (including the lobes), purple, in few-fld. persistently bracteate cymes. Sepals ·4–·5″ narrow-lanceolate with a slender acumen. Capsule ·25″ ellipsoid or globose glabrous.

Behar, *Beng. Pl.* My specimens, however, were collected from the United Provinces outside our area. Fl., Fr. Sept.–Nov.

Petioles about as long as the leaves. L. with very excurrent midrib. Peduncles 1–4″ with a pair of reflexed narrow lanceolate hairy bracts at the end and similar pairs at the cyme branches. Flowers usually 2–3 only. Corolla between campanulate and funnel-shaped with the lateral nerves of the bands scarcely stronger than the intermediate. Seeds mostly 4, pubescent or almost woolly at the margins.

8. **I. tridentata,** *Roth.*

A herb, not twining, with numerous prostrate stems 6–12″ long from a woody rootstock and sessile or subsessile oblong, oblanceolate or subquadrate, often hastate or lyrate leaves ·25–·75″, rarely up to 1·25″ long, usually broadly truncate or emarginate at the tip which

has 2–3 teeth, several spinulose teeth also at the hastate base. Flowers pale-yellow, 1–3 on a slender peduncle ·5–1″ long. Sepals glabrous elliptic-oblong ovate or somewhat obovate ·15″, or ·2–·25″ in fruit, decurrent on the thickened pedicel. Corolla ·3″ long (in my specimens, perhaps, sometimes larger). Capsule ·25″, subglobose, papery, 4–2-seeded.

Behar, *Hope*! Chota Nagpur. Singbhum, frequent in open places! Orissa, near Chilka Lake, *Cal. Herb.*! Fl., Fr. r.s.

Nearly or quite glabrous. Leaves with the excurrent midrib forming the centre tooth. Peduncles slightly hairy, with small persistent bracts ·06–·08″ long, often with a branch below the first flower ending in a pair of bracts and a second pedicel thicker than itself subalate with the decurrent sepals (much as in *Anaseia*).

9. **I. hastata,** *nov. comb.* Syn. I. angustifolia, *Jacq.*; Merremia hastata, *Hallier, f.*

Perhaps not specifically distinct from the last, but said to differ by being larger and twining, with larger flowers ·75″, funnel-shaped, yellow with purple eye. Sepals ·25–·3″. Capsule similar. Seeds similar, glabrous.

Orissa, near Chilka Lake, *Cal. Herb.*! Fl. May (and probably onwards).

I have sometimes seen *tridentata* with the ends of the branches spiral as though it might sometimes climb.

10. **I. cæspitosa,** *nov. comb.* Syn. I. linifolia, *Bl.*

A slender twiner, sometimes rooting at the lower nodes, with linear-oblong or narrowly elliptic-oblong leaves 1–2″ long, entire except sometimes the base shortly hastate and tip sometimes emarginate. Petiole hairy, ·1–·3″. Flowers yellow, ·7–·8″ long, in slender-peduncled cymes 1–2″ long.

Purneah! Sambalpur, *Cal. Herb.*! Fl., Fr. Sept.–Nov.

Stems usually with spreading hairs, sometimes glabrate (*F.B.I.*). Pedicels with two very small but conspicuous spreading lanceolate bracts at their base. Calyx ·15–·2″ long with oblong rounded sepals. Corolla campanulate, the bands distinctly nerved. Capsule as long as calyx, ovoid, papery, the septum usually evanescent. Seeds usually 4 glabrous.

11. **I. reniformis,** *Chois.* Syn. Evolvulus emarginatus, *Burm.* (1768); Merremia emarginata, *Hallier, f.*; Convolvulus reniformis, *Roxb.*

The name "*emarginatus*" appears to be the oldest, but its adoption, besides being less well known and less appropriate, involves yet another combination. Moreover, there is a doubt whether this is not *Convolvulus gangeticus, L.* (*Amœnitates Academicæ*, iv, 306, published about 1760), in which case the name should be *gangeticus*.

A small herb with creeping, not twining stems, rooting at the nodes and small, usually reniform, sometimes ovate cordate leaves, and small yellow flowers ·5–·75″. Capsule ·15–·2″, subglobose 2-celled.

Chota Nagpur. Singbhum! Manbhum, *Clarke*! Fl., Fr. Sept.–Dec.

Glabrous or nearly so. L. ·2–·75″ long or broad, sometimes up to 1·5″ (*Clarke*), crenate or dentate with petioles slender once to twice as long as the blade. Peduncle hardly any, 1–3-fld. Two outer sepals small, lanceolate or oblanceolate, three inner much larger entire or obcordate or 2-lobed, 1·2″ long, ciliate with long hairs. Corolla campanulate. Anthers oblong. Ovary glabrous, tip attenuate into the style, stigma very large. Pollen smooth. Seeds black, glabrous, often only 2.

12. **I. chryseides,** *Ker.*

A slender, nearly glabrous twiner with angled stems, deeply cordate ovate acuminate leaves about 1·5″ by 1·2″, shallowly 3-lobed and repand-toothed. Petiole about ·7″. Fls. yellow, ·7″ in forked axillary short- to very-long-peduncled 3–7-fld. cymes. Capsule ·25″ diam., broader than long, somewhat 4-sided, umbonate, seated on the green or brownish subequal sepals, which are ·2″ long, oblong-obovate with spreading tip and incurved often coloured margins.

In wet shady places rather common. Purneah! Singbhum! Ranchi, Neterhat! Parasnath! Manbhum! Sambalpur! Fl., Fr. Sept.–Dec.

Stems hairy at the nodes. Leaves 1·5-1″, rarely up to 2·3″ long, upper surface with hyaline scattered hairs, lower paler glabrous, side lobes rounded, terminal acuminate or obtuse and mucronate. Petiole slender ·7-1″, sometimes muriculate. Corolla ·5-·75″ long. Filaments villous at base. Seeds minutely dotted, villous round the hilum, minutely puberulous.

13. **I. obscura,** *Ker.*

A slender twiner with hairy stems, sub-orbicular or ovate deeply cordate leaves about 1–2·5″ each way, and rather small flowers ·75″ diam. yellow, or usually white with the bands yellowish, and always with a purple eye. Capsule much exceeding the sepals, ovoid, ·3-·45″, 2 (-4)-valved with 4 brown velvety seeds.

Behar, *Hope*! Ranchi, *Wood*! Manbhum! Palamau, frequent in the west in hedge-rows. Fl., Fr. Sept.-Dec.

Leaves with broad or narrow basal sinus, bluntly shortly acuminate or apex rounded, hairy beneath and slightly so above, about 7-palmately-nerved. Petiole shorter than or nearly as long as blade, hairy. Peduncles slender 1-3″ long or less, 1-2-fld., pedicels ·5-1″. Sepals ·15″ or in fruit ·2″ broadly ovate-oblong, shortly cuspidate, pubescent, dry in fruit and often reflexed.

14. **I. reptans,** *Poir.* Syn. I. aquatica, *Forsk.*; Kalmi-sag, *Beng.*; Karmi, *H.*

An aquatic herb with the stems creeping on mud and floating, with lanceolate to elliptic-oblong or ovate hastate or cordate leaves 1·5–6″ long and long slender petioles. Flowers 1–2″ long and 1·5″ diam., white or pale purple with a darker purple eye, solitary, or in 2-3-fld. peduncled cymes. Peduncles ·5- (f. *Clarke*) 7″ long. Calyx ·4″ long, sepals subequal, gland-dotted within, ovate or ovate-oblong obtuse, one or two mucronate. Capsule ·3″ ovoid, glabrous, 4–2-seeded.

Common in and on the sides of tanks, in all districts. Fl., Fr. practically all the year round. Said to be annual.

Glabrous except at the bases of the shoots and peduncles. Rooting at the nodes and with long floating stout and fistular stems often ·3″ diam. with milky juice. L. minutely dotted beneath, sometimes with a straight base, sec. n. about 3 each side at base and 6-8 above base. Petiole about three-fourths as long as the blade. Filaments thickened at base and densely papillose. Seeds nearly glabrous or microscopically hairy.

The tender shoots are eaten.

15. **I. pes-capræ,** *Sweet.* Syn. I. biloba, *Forsk.*; Convolvulus pes-capræ, *L.*; Dopati-lata, *H.*; Chhagal-khuri, *Beng.*; Kasari-nai, *Or.*

A prostrate and far-creeping herb from a large perennial elongate root. Stems glabrous. Leaves thick, 1·5–2·5″ long and ofter broader than long, emarginate to deeply 2-lobed at the apex, cuneate or straight at the base where are two large coloured glands. Flowers

bright rose-purple, darker in the throat, 1–2 rarely 3 on peduncles about as long as the leaves. Sepals oblong or ovate obtuse, the two outer smaller, transversely rugose towards the base. Capsule ·5″ ovoid, glabrous. Seeds villosely tomentose.

On the sands along the sea-face from Balasore southwards! Fl., Fr. most of the year.

Rarely twining. Petiole 1–4″. Peduncle 1–4″, bracts ·2″ lanceolate, caducous, pedicels ·6–1·7″ stout. Sepals ·3–·6″. Corolla 1·5–2″ long, scarcely lobed.

Useful as a sand-binder. *Roxburgh* states that it is eaten by horses and goats.

16. **I. sepiaria,** *Koen.*

A slender, rather variable, twiner glabrous (in our area) or pubescent with ovate cordate or hastate, or sub-3-lobed acute acuminate or shortly caudate leaves 1–2″ long, very slenderly palmately 5–7-nerved with only 2 sec. n. above the base. Flowers delicate purple or white with a purple eye, 1·5–2″ long and about 1·5″ diam. in sub-umbellate cymes, with short to long peduncles and short pedicels, with very small bracts at their base. Sepals ovate-oblong, ·2–·25″ with scarious margins, sometimes ·3″ in fruit. Capsule ·25–·3″ ovoid, 4-valved, 4–2-seeded. Seeds tomentose, black.

Singbhum, occasional near streams! Hazaribagh, *Anders.*; common in the extreme south of the province. Balasore! Puri! Fl., Fr. Nov.–April.

Branches sometimes pilose. Leaves sometimes with the basal lobes oblong and as large as the terminal lobe, glabrous in our specimens, sometimes sinuate. Petiole usually short, from half to five-eighths as long as the blade. Peduncles ·5–2·5′ stout and thickened upwards especially in fruit, often 7–9-fld. rarely only 3-fld., pedicels ·1–·25″ thick. Calyx quite glabrous, sepals with rounded often minutely mucronate tips. Corolla-tube somewhat funnel-shaped or broader and sub-cylindric, bands several-nerved.

17. **I. cymosa,** *Roem. & Sch.* Syn. Merremia umbellata, *Hallier*, f. The name *umbellatus* (*Convolvulus umbellatus, Wall. Cat.*) does not appear to have been published before *cymosa*. It is not the name corresponding to the plate in *Rumphius*.

Stems long herbaceous scrambling, and sometimes rooting at the nodes, usually not twining, slightly angular, young pubescent. Leaves 1·5–2·5″ oblong or elliptic or lanceolate, with broadly cordate or hastate base, upper sometimes linear and hastate, glabrous or puberulous above and sometimes thinly hairy on the nerves beneath; petiole short pubescent or hairy on the upper side. Flowers white or cream on axillary 2-several-fld. peduncles ·25–1·5″ long, pubescent at base, bracts subulate under ·1″. Pedicels ·2–·5″. Sepals ·3–·35″ membranous or fleshy with scarious margins, elliptic, ell.-oblong or somewhat ell.-obovate, obtuse and aristulate or apiculate, nerves very obscure. Corolla 1·5″ long (2″ in var. *macra, Clarke*), pubescent at the tip (best seen in bud), funnel-shaped from a tubular base ·3″ long. Filaments slender, slightly dilated at base, glabrous, anthers narrow-oblong, not twisted, pollen irregularly globose, smooth. Capsule ·3″ diam., globose, glabrous. Seeds ·25″ long, densely clothed with long soft spreading hairs.

In damp places. Bamur and Sambalpur, very common! Fl., Fr. Jan.–March.

The species is extremely variable. *De Candolle* (*Prodr.*, ix, 371) describes three varieties, and *I. caliginosa, Choisy*, is also supposed to be the same species, but none of these closely resemble the large-leaved form described below :—

Var. **cochleata,** *var. nov.* (var. macra, *Clarke?*).

Stems stouter, twining, with 2 or more raised lines and usually twisted, glabrous. Lower leaves often 5·5″ by 3·5″ ovate or ovate-oblong acuminate, shallowly cordate, sometimes slightly repand, otherwise entire, glabrous, or very slightly puberulous on nerves above, petioles 1·5–2·5″ glabrous, upper leaves gradually smaller and more oblong, and petioles proportionately shorter. Flowers white in many-fld. cymes 2–3″ long, sub-racemose on its branches. Peduncles 1–2″ glabrous. Bracts linear or subulate ·1–·12″. Pedicels ·3–·5″. Calyx pearly white, succulent, ·3″ or ·4″ in fruit, outer sepals concave ovate, aristulate, or with a small cusp, inner narrower, margins thin or scarious. Corolla, etc., much as in the type, sometimes only 1″ long.

Usually near rivers and streams. Singbhum, rather common! Manbhum! Palamau! Angul, common! Fl. Feb.–April. Fr. May. Evergreen, new shoots appear in June.

Juice slightly milky. Stems tough. L. with 6–9 strong sec. n., lowest 1–3 near base, tertiaries rather strong on the older leaves, upper leaves often more membranous and mucronate.

The flowers close in the evening as in many other species of the genus. They often do not open till noon.

18. **I. petaloidea,** *Chois.* Syn. Merremia crispatula, *Prain*; Convolvulus crispatulus, *Wall. Cat.* The name *crispatulus* does not, however, appear to have been published prior to *petaloidea*, *Wallich's* catalogue not being publication.

A climber, often large and shrubby, but sometimes flowering when quite small, stems with 2–4 raised lines or narrow wings, glabrous. Lower leaves ovate, often attaining 7″ by 5·5″ or more, with shallowly cordate, retuse or rounded base, and 2–3″ long petioles, upper leaves ovate-lanceolate to lanceolate-oblong 1·5–3″ long, with petiole ·3–·7″, all glabrous, and with characteristic reddish strong midrib and sec. n., and usually strong cross tertiaries. Flowers more or less yellow (sometimes white?) in 1-many-fld. rather dense cymes, with small linear very caducous bracts ·2–·25″ long. Flowers easily distinguished from those of *cymosa* by the sepals being ·6–·8″ long and by the corolla being densely hirsute except on the small basal tubular portion. Capsule about ·5″ ovoid. Seeds minutely velvety with subvillous margins.

Ranchi ghats! Manbhum, *Campbell*! Hazaribagh. *Wood*! Behar, *Kurz*! Angul! Fl. March–Sept. Perennial. New shoots in June.

Leaves very rounded, emarginate or obtuse and mucronate at the apex, rarely the upper ones somewhat acuminate, glabrous and somewhat glaucous beneath, mid-rib shining, strong sec. n. 6–9, of which 2–3 close to the base. Petioles often with two narrow wings or crisped margins on the upper side. Peduncle glabrous or closely pubescent. Pedicels ·5–·8″, somewhat thicker upwards. Outer sepals ovate or broadly elliptic concave acute or obtuse, sometimes with a minute apiculus. Corolla 1·75–2″ long. Capsule rather shorter than the calyx, papery, 2-celled with 4 lanceolate-oblong valves.

Var. **pauciflora,** *Clarke.*

A very depauperated form with stems from a woody rootstock, not climbing. Leaves oblong to linear or oblong-lanceolate 1–1·5″, with weak sec. n. and short petiole. Peduncles only 1-, rarely 2-fld.

Burnt grass lands on the plateau! Fl. May. An exactly similar form has been collected in Oudh!

19. **I. turpethum,** *Br.* Syn. Operculina turpethum, *Manso*; Bana etka, *S.*; Pitohri, *H.*: Tohri, *Beng.*

A large climber but stems scarcely woody, narrowly 3-4-winged. Lower leaves broadly ovate cordate, often 6″ by 4·7″, acuminate or acute and apiculate, upper often oblong obtuse and mucronate, petioles ·75–3″, with crisped wings above on the lower leaves. Flowers white in 3–5-fld. cymes 2–3″ long, including the pubescent peduncle, with large oblong cuspidate sub-persistent pubescent bracts ·5–1″ long. Sepals ovate-oblong or broadly elliptic, ·7–·75″ long, outer 2 subherbaceous very broad, 3 inner membranous, all enlarged, hardened and often split in fruit. Corolla glabrous glandular, with tube about as long as calyx and broadly campanulate limb 1·5–2″ diam. Capsule with the exocarp longitudinally or irregularly splitting (circumsciss according to some authors), leaving exposed the depressed globose transparent 2-celled endocarp. Seeds 4–1 obovoid brown, minutely reticulate glabrous, ·2″ long.

Not very common. Bettiah, *Hieronymus*! Singbhum! Manbhum, *Campbell*! Palamau, common about Garhwa! Angul! Fl., Fr. March–Dec. Perennial.

Juice rather milky. Stems, petioles, leaves and inflorescence shortly pubescent or downy or older parts glabrescent. Leaves with 9-12 strong sec. n., of which 2-3 close to the base, all nearly reaching margin, then incurved, tertiaries somewhat raised beneath, more or less scalariform, depressed above (when fresh). Pedicels 1-1·25″, lengthening and stouter in fruit. Fruiting sepals often 1″ across, brittle.

The powdered fleshy root made into a paste is applied in rheumatism, *Camp. Roxburgh* states that the bark of the roots is employed as a purgative. *Watt* states that it is a well-known purgative under the name of Turpeth-root or Indian Jalap. The Jalap of the British Pharmacopœia is the resin obtained from the roots of *Ipomœa purga, Hayne.*

Var. humilior.

Herbaceous, trailing. Stems angled or with raised lines only, pubescent. Leaves ovate to oblong-lanceolate, often subhastate, 1–2·5″. Peduncles often only 1-fld., with one pair of pubescent bracts only. Corolla 2″.

Santal Parganas! Bhagalpur, *Thomson*! Near river banks. Fl. Dec.

This is a much smaller plant and I doubt whether it would ever develop into the larger form as it appears to die down to the perennial root each year. It has been collected in various parts of India.

It has the characteristic small yellow resinous glands on the outside of the corolla as in the larger form, and which curiously do not appear to have been previously noticed.

20. **I. carnea,** *Jacq.* Syn. Argyreia superbiens, *Cave* (*teste Cal. Herb.*).

A large straggling shrub with very milky juice, ovate cordate acuminate leaves, larger 6″ by 4″ to 8·5″ by 6″, nearly glabrous, and large convolvulus-like pink flowers 3″ long and broad.

Very common in gardens in Chota Nagpur and sometimes used as a (very inefficient) hedge. Fl. chiefly c.s.

I am not quite sure of the correct name of this shrub; it is called *A. splendens* at the Agri-horticultural Society's Gardens, but is certainly not that. It climbs when given a chance but is usually cut back. Young twigs usually red. L. microscopically puberulous, sec. n. about 10 strong, of which 4 are close to base, tertiaries scalariform, conspicuous. There is a gland each side at the base of

mid-rib. Petiole 2–5″. Cymes lax, 2-chotomous, axillary and terminal, minutely pubescent, conspicuously marked with the scars of the very caducous oblong-ovate ·12″ long bracts. Peduncles 4–6″. Pedicels ·5–·8″. Calyx ·25″, sepals subequal broadly ovate-oblong rounded, a small gland each side of base of outer. Corolla broadly hypocrateriform, scarcely campanulate, purple inside, tube puberulous. St. unequal, ciliate below, anthers oblong, pollen spinulose. Ovary 4-celled. Fruit never seen and the genus therefore somewhat uncertain.

Propagated by cuttings.

21. **I. vitifolia,** *Sweet.* Syn. Merremia vitifolia, *Hallier.*

An extensive but scarcely woody twiner, hairy all over, with vine-like leaves 2–6″ diam., and bright primrose or sulphur-yellow very pretty flowers 2–2·5″ diam. in 1–7-fld. peduncled hairy cymes. Capsule ·5″ diam, irregularly breaking up, semi-transparent, usually 4-seeded.

In the damper localities, especially along streams. Purneah! Santal Par.! Singbhum! Hazaribagh, *Wood*! Palamau, *Gamble*! Rairakhol! Angul, common! Sambalpur! Probably therefore in all districts in suitable localities. Fl. Oct.–March. Fr. March–May. Perennial, nearly evergreen.

Leaves suborbicular or broadly ovate in outline cut one-third to one-half the way down into ovate or triangular acute or acuminate lobes which are often strongly toothed, palmately nerved with 5–7 basal nerves, hairy. Petiole ·5–4″. Peduncles 1–4″. Sepals ·5″ hirsute, hardened and ·7–·9″ in fruit. Corolla 2″ long, glabrous. Seeds black or slate-coloured with a matt surface.

22. **I. palmata,** *Forsk.* Syn. I. pulchella, *Roth.*; The Railway Creeper.

An extensive climber with somewhat fleshy slender stems and branches, the older tubercled with large lenticels. Leaves 1–2·5″ long and broad, deeply 3–7 (usually 5)-palmately lobed almost to the base with elliptic or lanceolate or oblanceolate subentire usually obtuse and mucronate lobes. Flowers very numerous, usually solitary (1–3) on the peduncles, violet-purple with purple tube, 1·25–2″ long and about as wide, funnel-shaped with spreading limb. Sepals ·25″, ell.-oblong with membranous margins. Capsules ·4″ ovoid, glabrous, 2-celled, 2–4-valved. Seeds pubescent with woolly margins.

Exceedingly common on trellisses, etc., in gardens and on railway platforms, and nearly constantly in flower. Native near the coast in the Bombay Presidency.

Easily grown from cuttings of the branches.

23. **I. sinuata,** *Orteg.* Syn. I. dissecta, *Pursh.*

Similar in habit to the last with which it is often associated in gardens, etc., with pretty 5-palmatisect leaves about 3″ diam., each segment again pinnatifid or unequally deeply lobed, basal segments each with a very large basal lobe. Petiole short, with few long hairs. Peduncles 1-fld. Fls. white 1·5″ diam. with a purple eye. Sepals subequal, broadly lanceolate, membranous with green pulvinate base and cuspidate tip, ·7–·8″ long. Corolla tubular below then funnel-shaped and with spreading limb. Ovary 2-celled.

Common in gardens. Native of tropical America. Fl., Fr. chiefly r.s.

24. **I. quinata,** *Br.* Khalkhatia, *Or.*

Prostrate or twining with very slender glabrous or patently hairy stems, palmately compound 5-foliolate leaves with sessile lanceolate, narrowly elliptic or rhomboid acuminate leaflets, 1–2″ long in the upper leaves, sometimes attaining 4″ by 1·25″ in the lower leaves,

nearly glabrous. Flowers white 1·5″ diam. on 1- or usually 2-fld. peduncles ·75–2″ long. Capsule ·5–·75″, ovoid, subacute, glabrous and shining, 2–4-valved.

In open jungles. Singbhum, frequent! Ranchi! Hazaribagh, *Clarke*! Manbhum, *Kurz*! Bonai! Fl., Fr. Aug.–Oct.

Leaves with lower petioles 2″, upper petioles ·25–·5″, glabrous or with spreading hairs. Leaflets sessile or subsessile, tapering at the base, glabrous or hairy on the nerves beneath, sometimes linear-lanceolate. Bracts linear persistent. Sepals ·3–·4″ long, elliptic or ell.-oblong, brownish with membranous margins, sometimes ·5″ in fruit, two inner the larger. Corolla 1·5″ long, funnel-shaped, bands several-nerved. Anthers curved. Seeds glabrous, shining, with the apex crested.

25. **I. hederacea,** *Jacq.* Syn. Convolvulus hederaceus, *L.*; Ipomea nil, *Roth.*; Pharbitis nil and P. hederacea, *Chois.*

A hairy twiner with retrorsely hirsute stems, ovate cordate 3-lobed leaves 3–5″ long, and handsome bright-blue or rose-coloured flowers 1·5–2″ long with very long sepals, subumbellate on 1–5-fld. peduncles.

Common in hedges near villages in Chota Nagpur! Fl. Aug.–Nov. Fr. Oct.–Dec.

Leaves thinly hairy, lobes broadly ovate or oblong very acuminate. Petioles 1·5–4″. Peduncles hirsute with reflexed hairs 1–3″, rarely 4″, bracts linear. Sepals linear-lanceolate ·7–1″ long, hairy below, not enlarged in fruit. Anthers not twisted. Capsule subglobose ·3″, glabrous. Seeds glabrous.

The seeds are said to be eaten.

26. **I. digitata,** *L.* Syn. I. paniculata, *L.*; Convolvulus paniculatus, *L.*; Bhumikumra, *Beng.*; Bilai kand, *H.*

An extensive twiner from a tuberous root with glabrous stems and sub-orbicular deeply 5–7-palmately lobed leaves 3–7″ diam. with elliptic or lanceolate or spathulate lobes and widely cordate base. Flowers 1·5-2·5″ widely campanulate, pink-purple (dark reddish-purple, *Roxb.*), many in a long-peduncled dense corymbose cyme. Ovary and capsule 4-celled, 4-valved with closely cottony or woolly seeds.

Purneah! Fl., Fr. r.s. Deciduous Dec.–Jan.

Leaves glabrous, usually lobed beyond the middle or nearly to base, bluntly acuminate, nerves about 5–7 basal and two higher up. The leaf much resembles that of *Modecca*, but lacks the large glandular areas. Petioles 2–5″. Peduncles about as long as the petioles or 6–10″. Pedicels ·25–·5″. Bracts minute deciduous. Fls. sub-umbellate. Sepals elliptic ·25–·5″, wider in fruit and concave and rather fleshy. Corolla with a narrow-tubular base scarcely exceeding calyx. Anthers not twisted. Capsule ovoid ·3–·5″ long. The wool on the seeds is sometimes exserted from the capsule fissure.

The tuberous roots are used in native medicine as tonic and lactagogue. The plant is also sometimes cultivated for its flowers.

27. **I. batatas,** *Lamk.* Uku-sangar, *K.*; Sakakanda, *H.*; Kanda, *Or.*; The Sweet Potato.

A prostrate plant with milky juice and triangular or ovate usually sharply and irregularly lobed leaves 2–4″ long with more or less cordate base and long stout petioles 2–8″. Flowers purple 2″ long and broad 2-several on long axillary peduncles with short pedicels and very small bracts at the base of the pedicels.

Cultivated in all districts, chiefly in sandy ground near rivers. Fl. about January, and as the tubers are usually lifted in November to December the natives often say that it does not flower. I have not seen the fruit. Native of America.

Stems glabrous or usually hairy. Some leaves often simple, usually acuminate but shape very variable and often broader than long, base 9-nerved, glabrous. Peduncles about as long as the petioles. Sepals ·2-·3″, outer usually smaller, midrib excurrent as a small awn.

12. HEWITTIA, *W. & A.*

Twining usually pubescent herbs with cordate, sometimes 3-lobed leaves and mod.-sized flowers in 1–many-fld. axillary sometimes subcapitate cymes. Bracts narrow. Sepals unequal, outer much larger than the inner, accrescent in fruit. Corolla campanulate. Stamens included or sub-exsert, filaments dilated at the base, anthers shortly lanceolate. Ovary 1-celled or partially septate, 4-ovuled. Style filiform, stigmas 2 ovate-oblong. Capsule globose, 4-valved. Seeds glabrous.

1. **H. bicolor,** *Wight.*

A twiner with pubescent stems, petioles, peduncles and leaf-nerves, somewhat resembling the small form of *Ipomœa turpethum*. Leaves cordate ovate simple or somewhat lobed, acute or acuminate, attaining 5″ by 4″, somewhat shiny both sides. Flowers pale yellow with a purple throat, 1–1·2″ diam., on 1- (rarely 2-3-) fld. peduncles with 2 lanceolate bracts.

Thickets near watercourses, Singbhum! Not common. Fl., Fr. Jan.–Feb.

Leaves sometimes hairy all over beneath, tip sometimes shortly caudate, principal nerves 5–6 palmate, sec. n. of midrib 2–4. Petiole of lower leaves sometimes 3·5″, of upper short. Peduncles variable in length, usually short. Bracts lanceolate ·25–·5″, a little below the calyx. Outer sepals foliaceous ovate, ·5″, inner lanceolate or oblong, dry and reticulate in fruit. Corolla hairy or pubescent, shortly 5-lobed. Ovary villous.

13. CONVOLVULUS, *L.*

Herbs or undershrubs, erect, prostrate or twining with entire, toothed or lobed leaves. Flowers of various size and colour, solitary or in several- to many-fld. cymes. Sepals subequal or the outer wider. Corolla campanulate or widely funnel-shaped nearly entire, the 5 bands on the corolla usually distinct. Stamens included, often unequal, filaments with somewhat dilated base, anthers narrow, pollen smooth sometimes furrowed. Disc annular or cup-shaped. Ovary 2-celled. Style slender, stigmas 2 filiform to oblong or subclavate. Capsule globose, 2-celled, 4-valved or more rarely irregularly breaking up. Seeds glabrous.

The genus **Jacquemontia** differs by the stigmas being short, ovate or lanceolate and compressed, and our species *Convolvulus parviflorus* (or *Convolvulus paniculatus*) has been called recently *Jacquemontia paniculata*. But it appears better to me to keep it in *Convolvulus* in consideration of *Jacquemontia* being essentially an American genus and that the shape of the stigma is somewhat variable in both genera.

J. cœrulea, *Choisy*, is a very pretty slender climber with cordate leaves and blue flowers with a wide open mouth. In habit not unlike *Convolvulus parviflorus* but stigmas are shorter and elliptic-oblong. It is a native of America commonly cultivated in gardens.

A. Stems several prostrate. Stigmas filiform as long as the style	1. *pluricaulis.*
B. Stems twining. Stigmas not as long as the style:—	
Stigmas linear, slender ·15″	2. *arvensis.*
Stigmas short, linear ·05″, not slender	3. *parviflorus.* (*paniculatus.*)

1. **C. pluricaulis,** *Chois.* Evolvulus ferrguineus, *Wall.*

A herb with many sub-erect and prostrate hairy stems 4–12″ long from a woody rootstock and linear, or lower somewhat oblanceolate, leaves ·5–1·5″ long. Flowers pale rose numerous on axillary 1–3-fld. peduncles or peduncles 0. Sepals ·2–·3″, narrowly linear-lanceolate, hairy. Corolla ·9″ diam. (in a specimen of mine, var. *macra* ?), or only ·25–·3″ (in *Wallich's* specimen), widely funnel-shaped and showing the stamens. Stigmas filiform ·2″ long. Capsule ovoid glabrous ·17–·2″ long.

Behar, *Kurz*! Bhagalpur, *Wall.*! Raneeganj (close to Manbhum), *Cal. Herb.*! Sarguja, *Cal. Herb.*! Fl., Fr. May–Dec.

Branches often fulvous-hairy when dry. Cauline leaves mostly ·6″ or less upwards, linear-oblong, hairy. Pedicels 0–·17″. Corolla hairy outside.

2. **C. arvensis,** *L.*

A pretty twining herb with long cylindric slender rhizomes and glabrous or slightly pubescent stems. Leaves 1–3″ ovate cordate, auricled or hastate. Flowers pretty pink and white streaked. Sepals ·17–·2″, sometimes ciliate. Corolla with very wide mouth, 1″ diam. Stigma ·15″ linear. Capsule ·25″ glabrous.

An occasional weed of cultivation in the Northern Area. A pest in gardens in Europe from the slender creeping rhizomes.

3. **C. paniculatus,** *comb. nov.* Syn. Ipomœa paniculata, *Burm.*; Convolvulus parviflorus, *Vahl.*; Jacquemontia paniculata, *Hallier f.*

A slender twiner more or less pubescent all over (in our specimens, or nearly glabrous, *Clarke*) with ovate finely acuminate leaves 1–2″ long and small white or pinkish flowers in axillary peduncled cymes shorter than the leaves.

Monghyr Hills, *Kurz*! Puri Mals! Fl., Fr. April–Jan.

Leaves shallowly cordate or base straight, sec. n. 5-7, of which 2-3 are from the base and almost palmately nerved (only a little weaker than midrib). Petiole slender ·5–1″. Peduncles ·5–1·3″, shorter or longer than the petioles, 2–5-fld. Sepals ovate or lanceolate, acuminate, pubescent ·25″. Corolla ·5″ long, mouth not dilated, about ·3″ diam. Stigmas linear but rather stout, terete and very slightly dilated at the tips, recurved, ·05″ long. Capsule ·2″ globose, glabrous.

14. CALYSTEGIA, *R. Br.*

As in *Convolvulus* but with large foliaceous persistent bracts enclosing the calyx. Ovary 1-celled or incompletely 2-celled. Stigmas 2, ovate, or shortly oblong, compressed.

1. **C. hederacea,** *Wall.*

Prostrate as a weed of cultivation or climbing 6 ft. in bushes (*Clarke*). Stems glabrous. Leaves cordate or sagittate entire or lobed, ·5–1–3″, very irregular in form. Petiole 1″. Peduncle 2″ with ovate bracts ·3″. Sepals ·3″, oblong, obtuse, glabrous. Corolla 1″ sub-campanulate, pink-purple. Capsule ·3″ ovoid, subacute, glabrous.

Purneah, *Kurz*! Fl. Dec.–Jan. Fr. Feb.

Usually dwarf trailing with somewhat deltoidly hastate or ivy-like 3–5-lobed leaves often under 1·5″ with the mid-lobe generally larger and oblong. Peduncles sometimes slender and up to 4″ long. Bracts ·3″, persistent and enclosing the fruit. Corolla sometimes white with pinkish limb or lilac.

15. ERYCIBE, *Roxb.*

Climbing shrubs with the innovations often ferruginous pubescent. Leaves entire coriaceous. Flowers small or m.s. in axillary and terminal cymose racemes or panicles. Sepals subequal, coriaceous. Corolla white or yellowish with a shortly campanulate tube and spreading limb with 5, 2-lobulate, induplicate lobes. Stamens inserted low in the tube, sub-included, with short filaments and lanceolate basifixed apiculate anthers. Ovary 1-celled, 4-ovuled. Style hardly any, stigma large sub-globose 2-lobed (or sometimes 5-lobed!) Fruit baccate, 1-seeded. Albumen scanty, irregularly intruded between the plicate fleshy cotyledons.

1. **E. paniculata,** *Roxb.* Urumin, Hurmi, *K.*; Kari, *S.*; Durkuli Jorai-kuli, *Or.*; Chimina (Sambalpur).

A large climbing shrub with conical protuberances on the trunk, rusty-tomentose shoots, entire oblong, ell.-oblong, oblanceolate or obovate, acuminate leaves about 5″ by 1·5″ and terminal rusty-tomentose panicles of yellowish-white flowers ·5″ diam. with crisped marginate petals. Berry black ·6″ with dark-purple flesh, seated on the spreading calyx.

Along rivers and streams, Champaran! Santal P.! Gaya Ghats! Throughout Chota Nagpur, frequent! Throughout the Southern area! Fl. May–June. Fruit ripens the following May. Evergreen.

L. 3–6″, tomentose when young, shining and glabrous when old, sometimes punctulate beneath, long- or shortly-acuminate, base usually narrowed into the ·4–·5″ long petiole, sec. n. 4–6 oblique, not prominent. Panicles narrow, 4–7″ long. Sepals ·1″, oblong rounded or orbicular. Corolla-tube as long as calyx. Stigma sessile sub-globose, sometimes 5-lobed. Seed elliptic ·3″.

The fruit is sweet and is eaten. The bark is given by the Santals in cholera.

16. CUSCUTA, *L. Dodder.*

Leafless, yellow-green, reddish, or colourless, rootless parasites, with twining uniformly slender often thread-like stems furnished with haustoria. Flowers small, white or rose, in cymes or fascicles, usually with small bracts. 5-merous or sometimes 4-merous in the same species. Sepals subequal, free or shortly connate. Corolla ovoid or campanulate, persistent, lobes small, imbricate in bud, tube naked or with a ring of scales below the stamens. Stamens inserted below or in the throat, often shortly exserted. Ovary 2-celled, sometimes incompletely, styles 2 distinct or connate, stigmas round or acute. Ovules 4. Fruit capsular, dry or fleshy, circumsciss or irregularly breaking up. Seeds 1–4, smooth. Embryo peripheral, spiral or annular, in fleshy albumen, cotyledons 0 or rudimentary.

Style connate below, 2-lobed above. On trees or shrubs . . . 1. *reflexa.*
Styles 2, stigmas capitate. On herbs . . . . . 2. *chinensis.*

1. **C. reflexa,** *Roxb.* Jansing, *K.*; Alaj-jari, *Kharw.*; Algusi, *Beng.*

Stems rather stout for the genus, fleshy, usually yellowish-green or yellow, often in dense masses with pendulous branches covering small trees and shrubs. Flowers white or pinkish, sweet-smelling of an evening, ·25–·3″ long, tubular-campanulate with short reflexed lobes, solitary and in few–many fld. racemiform cymes with bracteate pedicels or sometimes fls. sessile. Scales at base of corolla emarginate

fimbriate. Ovary narrowed into a very short style with 2 lanceolate branches or stigmas. Ovules on a very spongy thick placenta. Unripe fruit very fleshy with black marks or warts, ripe about ·3″ diam. fleshy circumsciss near the base 1–4-seeded.

In all districts. Chiefly on *Zizyphus* and *Acacia*. Fl. Oct.–Dec. Fr. Dec.–Jan.

2. **C. chinensis,** *Lamk.*

A delicate thread-like pale-yellow twiner with flowers in dense often very numerous clusters. Sepals nearly free, triangular-ovate, ·05–·06″ long, subobtuse. Corolla-lobes ovate, scales shortly fimbriate. Fruit ·15″ (ripe ?).

On *Polygonum*, *Portulaca*, *Guizotia*, etc. Lohardaga, *Clarke*! Manbhum, *Camp. Herb.*! Fl. July–Nov.

FAM. 97. SOLANACEÆ.

Herbs, more rarely erect or climbing shrubs, very seldom small trees, without milky juice. Leaves alternate, sometimes in unilateral pairs especially towards the inflorescence with the two members of the pair often unequal, simple, rarely pinnate, exstipulate. Flowers usually m.s. or large, regular, and 5-merous (exc. in the gynæceum), more rarely zygomorphic, or 6–7-merous, terminal on main or lateral shoots, solitary and often (conspicuously) extra-axillary or in cymose often extra-axillary inflorescences. Calyx persistent. Corolla sympetalous of various shape, usually plicate in bud or the lobes valvate, rarely imbricate. Stamens on the corolla-tube isomerous with and alternate to the corolla lobes, in zygomorphic flowers often unequal or some rudimentary; anthers sometimes dehiscing by apical pores. Hypogynous disc usually evident. Ovary superior usually obliquely 2-celled, rarely (*Nicandra*) 3–5-celled, or 4-celled,* or by abortion of the septum 1-celled. Style simple, stigma 2-lobed or -partite. Ovules very many on prominent peltate placentæ (1 or few in a few exotic genera), anatropous or slightly amphitropous. Fruit baccate or capsular, usually 2-celled, many-seeded. Seeds compressed, discoid or subreniform. Embryo often curved and peripheral in the albumen, more rarely straight.

The endemic Solanaceæ form a sufficiently characteristic family in our area, but the Tribe *Salpiglossideæ*, which has zygomorphic flowers and often only 2-4 fertile sometimes didynamous stamens as well as straight embryo and contains the well-known garden plants *Salpiglossis*, *Schizanthus*, *Browallia* and *Bruufelsia*, are only separable from the Scrophulariaceæ by the corolla being plicate in bud, with the exterior portions valvate.

I. Indigenous genera. Flowers regular or nearly so with equal or only slightly unequal stamens. Embryo much curved :—
  A. Calyx reticulate-veined and greatly enlarged in fruit. Fruit baccate enclosed in the inflated calyx :—
    1. Flowers solitary :—
      Fls. m.s. blue-purple. Ovary unequally 3-5-celled . 1. *Nicandra.*
      Fls. axillary, yellowish or white, often small. Ovary 2-celled . . . . . 2. *Physalis.*
    2. Flowers clustered. Corolla tubular-campanulate . 3. *Withania.*

* Sometimes many-celled in cultivated forms of *Lycopersicum*.

B. Calyx not greatly enlarged and never completely enclosing the fruit :—
1. Flowers rotate. Fruit baccate :—
a. Ovary 2-celled, fruit sometimes 1-celled above. L. not pinnate (sometimes pinnatisect) :—
Fls. 1–3 axillary. Filaments longer than the anthers . . . . . 4. *Capsicum*.
Fls. cymose, cymes usually extra-axillary. Filaments shorter than the anthers which open by pores or slits . . . . . 5. *Solanum*.
b. As in *Solanum*, but L. pinnate, anthers opening by long slits, ovary 2–3-many-celled . . . . . 6. *Lycopersicum*.
2. Flowers very large tubular or funnel-shaped. Fruit capsular. Ovary 3- or 4-celled . . . . . 7. *Datura*.
II. Exotic genera. Flowers often zygomorphic. Embryo straight or slightly curved only :—
A. Stamens all fertile, equal or unequal :—
Shrubs. Fruit baccate . . . . . 8. *Cestrum*.
Herbs, glandular-pubescent. Fruit capsular . . . . 9. *Nicotiana*.
B. Stamens only 2–4 fertile, the 5th rudimentary—Tribe Salpiglossideæ. (Only in gardens in our province and not further dealt with.)

1. NICANDRA, *Adams*.

Calyx with 5 large foliaceous deeply cordate lobes much accrescent in fruit, reticulate-nerved and enclosing the fruit as in *Physalis*. Ovary somewhat irregularly 3–5-celled (probably by false septa). Placentæ large unequal on the inner angles and walls. Fruit a somewhat dry berry with numerous flat seeds and strongly curved embryo.

A single species, native of Peru.

1. **N. physaloides,** *Gærtn*.

An erect annual glabrous herb with ovate or ovate-lanceolate lobed or coarsely toothed leaves 3–6″ long tapering into the petiole and handsome light purple flowers 1″ or more diam. terminal and becoming leaf-opposed or axillary. Sepals overlapping and making the calyx 5-angular, somewhat cuspidate, over 1″ in fruit. Corolla with somewhat campanulate tube and spreading limb.

More or less naturalised on the Vindhyan plateaux and sometimes seen in gardens! Fl. Oct.–Nov.

2. PHYSALIS, *L*.

Glabrous or hairy herbs with the hairs sometimes stellate and with entire or somewhat lobed leaves and solitary axillary flowers. Calyx campanulate, 5-fid, greatly enlarged and bladder-like enclosing the fruit. Corolla campanulate, usually yellowish. Stamens attached near the base, anthers attached near the lower end of the very small connective. Ovary 2-celled. Fruit baccate, seeds compressed, embryo peripheral curved.

Corolla ·2–·25″ with sometimes small spots at base. Fruiting calyx ·5–1″ long . . . . . 1. *minima*.
Corolla ·5″ with 5 large purple spots near base. Fruiting calyx 1–1·75″ long . . . . . 2. *peruviana*.

1. **P. minima,** *L*.

An erect herb 4–15″ high with pubescent or puberulous stems and membranous ovate toothed sinuate or lobulate acuminate leaves

·7–1·2″ in small plants, 1–2·5″ in large plants. Flowers small yellow ·2–·25″ long and broad, the corolla often with small spots at the base within. Fruiting calyx subglobose ·5–1″ long.

A common weed. Chota Nagpur! Probably in all districts though not collected. Fl., Fr. Aug.–Dec.

Leaves pubescent or puberulous. Calyx pubescent or hairy, the teeth not much enlarged in fruit.

Var. **indica,** *G. B. Clarke,* has a laxer habit with leaves usually more entire, calyx often more glabrous, and the fruiting calyx more ovoid with 5 distinct angles or wings.

2. **P. peruviana,** *L.* Tiparee, *Vern.*; The Cape Gooseberry.

A more bushy plant than the last with larger flowers and other characters of the Key.

Frequently cultivated for its fruit!

3. WITHANIA, *Panq.*

Shrubs with entire leaves and usually small white or yellowish flowers clustered in the axils with short pedicels. Calyx campanulate, 5-toothed, much enlarged and sub-globose in fruit, open or closed. Corolla tubular-campanulate, deeply 3–6-lobed. Stamens at the base of the tube. The rest as in *Physalis.*

1. **W. somnifera,** *Dun.* Asgand, *H.*

An erect weedy-looking shrub or undershrub, 2–4 ft. with subtomentose branches, entire ovate sub-obtuse leaves 2–4″ with shortly cuneate base and greenish or yellowish flowers ·3–·5″ long fascicled in the leaf axils. Berry ·25–·3″ diam. enclosed in the inflated membranous calyx which is ·5–·8″ long with very narrow mouth and unaltered lobes.

Occasional in waste ground. Gaya! Purneah, *Kurz*! Fl., Fr. Oct.–May.

Branches with large pith. Leaves glabrescent. Petiole ·3–·7″. Flowers shortly pedicelled with calyx ·2″ long.

The root is long, smooth and terete, whitish-brown. It is regarded as tonic and alterative and used in consumption, debility, etc., *Dutt.* The plant contains a poisonous alkaloid, and the seeds possess, like those of *W. coagulans,* the property of coagulating milk. *Nadkarni.*

4. CAPSICUM, *L.* Chillee.

Herbs or undershrubs with simple entire or repand leaves and white, rarely purple solitary or 2–3 axillary flowers. Calyx broadly campanulate, subentire or with 5 small teeth, not or scarcely enlarged in fruit. Corolla rotate, 5-lobed, valvate in bud. Filaments longer than the anthers, inserted at the base of the corolla, anthers dehiscing longitudinally. Berry very variable in form and size, sometimes only 2-celled in the lower part. Seeds discoid smooth or subscabrous. Embryo curved.

De Candolle considers that no *Capsicum* is indigenous in the Old World and I have never found a *Capsicum* even apparently naturalised in our area. The wild form of *C. annuum* is not known; he considers its original home in Brazil. *C. frutescens* has been found wild from the Amazons to Eastern Peru. The following description of varieties is after *Bengal Plants*:

I. Pedicels solitary, erect or reflexed; fruits erect, spreading or pendent, as long as, or longer than, the pedicels. Annual or biennial:—
  A. Flowers white; berries at first green, afterwards becoming red, orange or yellow:—
    1. Fruit not globular:—
      a. Berries tapering, much longer than broad:—
        Fruit stout, mildly pungent, calyx not enclosing its base . . . . . 1. *annuum.*
        Fruit slender, keenly pungent; calyx enclosing its base . . . . . var. *acuminata.*
      b. Berries not much, if at all, longer than broad, usually obtuse; calyx not enclosing base of berry:—
        Berries circular in section, subconic or ovate or oblong; flesh thin pungent . . . . . var. *abbreviata.*
        Berries swollen, angular in section, prismatic or quadrate or oblate; flesh very thick, hardly pungent . . . . . var. *grossa.*
    2. Fruit globular, extremely pungent . . . . var. *cerasiformis.*
  B. Flowers purple; berries at first dark purple, afterwards becoming orange red, much longer than broad, only slightly pungent; calyx hardly enclosing the base . var. *nigra.*
II. Pedicels 2 or more, erect; fruit always erect, red, shorter than the pedicels, pungent; perennial; fls. white:—
  Berries elongate, tapering, base embraced by the calyx . 2. *frutescens.*
  Berries globose or nearly so, base seated on the calyx . var. *baccata.*

1. **C. annuum,** *L.* Chillie, Nepal Pepper.

Var. **acuminata,** *Fingerh.* Gachh mirich, *Vern.*
Var. **abbreviata,** *Fingerh.*
Var. **grossa,** *Sendt.* Kaphari mirich, *Vern.*; Spanish Pepper.
Var. **cerasiformis,** *Mill.* Cherry pepper.
Var. **nigra,** *Prain.* Purple Chillie.

All more or less cultivated in our area.

2. **C. frutescens,** *L.* Dhan gachh mirich, Dhan lanka mirich, *Vern.* Bird's eye; Chillie.

This, as its name implies, is much more shrubby than the last and is sometimes 6 ft. high.

It is said to be quite naturalised in some parts of Bengal. Common in gardens and near gardens in our area.

Var. **baccata,** *Irish.* **C. minimum,** *F.B.I.*, in part. Brazil Pepper or Pimentas.

Occasionally cultivated.

5. SOLANUM, *L.*

Small trees, shrubs or herbs, sometimes climbing, usually with stellate indumentum, sometimes spinous, with alternate or paired, entire or lobed or pinnatifid leaves and cymose, rarely solitary, regular (or in one section zygomorphous) flowers. Calyx 5–10-toothed or -partite, not or somewhat enlarged in fruit. Corolla rotate, rarely broadly campanulate. Filaments usually shorter than the anthers inserted at the base of the corolla, anthers with the outer wall thicker than the inner, usually conniving in a tube and dehiscent by terminal pores or short slits. Berry usually globose, sometimes elongate in cultivation. Seeds very many, discoid. Embryo curved peripheral.

I. Unarmed. Anthers short, not attenuate (or only at apex):—
A. Roots with tubers. The Potatoe . . . . . 1. *tuberosum.*
B. Roots without tubers:—
1. Herbaceous. Fls. small, white, ·3″ diam. . . . 2. *nigrum.*
2. Shrubby. Fls. over ·5″ diam.:—
Climbing shrub, cultivated only . . . . . 3. *Seafortheanum.*
Erect, densely tomentose shrub. Leaves simple entire 4. *verbascifolium.*
II. Armed with prickles (exc. in some cultivated forms of 9).
Anthers long, usually attenuate from half way up:—
A. Leaves simple entire, lanceolate acuminate, pure white beneath. Large shrub . . . . . 5. *giganteum.*
B. Leaves mostly lobed, ovate or oblong:—
1. Erect shrubs or undershrubs, or (*melongena*) herbaceous:—
a. Leaves stellate tomentose both sides. Calyx and ovary hirsute . . . . . 6. *ferox.*
b. Leaves often stellate tomentose beneath, glabrescent or thinly stellate-pubescent above. Calyx not hirsute:—
i. Fls. mostly under 1″ diam. Berry ·3-·5″. Prickles short, triangular or curved:—
Leaves unarmed or with only 1 prickle beneath, calyx unarmed. Flowers white . . . 7. *torvum.*
Leaves with prickles, calyx usually prickly. Flowers blue, rarely nearly white . . . 8. *indicum.*
ii. Flowers mostly over 1″ diam. Berry 1″ or more. Prickles on branches usually under ·4″, sometimes 0 . . . . . 9. *melongena.*
2. Diffuse, herbaceous, with long straight prickles ·4-·7″ all over. Flowers 1″ diam., blue. L. usually doubly lobed . . . . . 10. *xanthocarpum.*
3. Climbing, with short prickles all over. Leaves small . 11. *trilobatum.*

A few other species are cultivated in gardens, but are not general.

1. **S. tuberosum,** *L.* Alu, *Vern.*; The Potato.

A herb with large unequally and irregularly pinnatisect leaves and terminal (subsequently becoming lateral) cymes of blue or white flowers 1″ or more in diameter.

Cultivated in the province in the cold season, but more especially in the Northern Tract and on the highlands of the Central Tract, only on a very small scale elsewhere, usually in the river beds.

The dreaded Potato disease (*Phytophthora infestans*) is almost unknown in the province, but in 1912-13 the potato crop in Bhagalpur was destroyed by it. This was due to the introduction of seed potato from the hills followed by damp foggy conditions in December (*Memoirs of Dept. of Agriculture*).

2. **S. nigrum,** *L.* Makoi, *H.*; The Black Nightshade.

An erect branched herb with entire or sinuate or sometimes toothed or lobed ovate or lanceolate-ovate or oblong leaves only ·5–1·5″ in starved specimens, attaining 4″ by 1·7″ in luxuriant specimens, blade always decurrent on the petiole. Fls. small white ·3″ diam. few sub-umbelled on extra-axillary peduncles. Calyx ·25″ diam. with broad rounded lobes. Berry ·25–·3 diam. globose black (sometimes yellow or red, *Clarke*).

A frequent weed especially in the Northern Area! Singbhum! Palamau and Hazaribagh, *Wood.* Fl., Fr., most of the year. Extends to Europe.

Branches with raised lines and leaves glabrous or slightly pubescent. Petiole ·5-1″. Pedicels deflexed in fruit about ·5″ long. Anthers short, not at all attenuate.

The berries are said to be eaten. They are alterative and diuretic and a decoction of berries and flowers is said to be useful in cough and consumption. The plant has the same chemical constituents as the English *S. dulcamara* (the Woody Nightshade) and contains the alkaloid Solanine. *Nadkarni.*

3. **S. Seaforthianum,** *Andrews.* The Potato-creeper.

A pretty scandent shrub with the lower leaves ternatisect with lanceolate acuminate lobes, the upper simple lanceolate undulate. Flowers blue or flesh coloured in axillary cymose panicles.

Frequent in gardens. Native of the West Indies.

Two other plants are sometimes called Potato-creeper, viz. *S. Jasminoides, Paxt.*, with ovate or ovate-lanceolate subcordate obtuse or acuminate leaves often unequally 2-5-partite, or lower 3-foliolate, and panicles of white or pale-blue small fragrant flowers on slender pedicels.

A native of Brazil.

S. Wendlandii, Hook. f., with a few short hooked prickles on the stems, branches and petioles. Leaves very variable in size, lower 6–10″, pinnate below and pinnatifid above, with 4–6 lobes or leaflets each side which are ovate or oblong. Corolla very pale lilac-blue 2·5″ diam. in cymes 6″ or more.

A very handsome species, native of Costa Rica.

4. **S. verbascifolium,** *L.* Bondu, *M.*; Arosa, Urusa, *Beng.*

A large shrub 6–20 ft. high with white or buff stellately tomentose unarmed stems and branches, large lanceolate or elliptic acuminate leaves 6–12″ long, stellately tomentose beneath and less so above, and white flowers ·75″ diam. in long-peduncled cymes 2–5″ broad. Berries yellow, stellate when young, ·3″ diam.

Northern Tract from Champaran ! to Purneah; Waste ground and scrub jungle Ranchi and Porahat plateau ! Fl., Fr. Aug.-Dec. Evergreen.

L. sometimes ovate or ovate-lanceolate 3–6″ broad with petioles 1–2″. Corymbs terminal, becoming lateral in fruit, tomentose, on stout peduncles 1–4″ in flower or 3–4″ in fruit. Calyx ·25–·3″ long with ovate or deltoid teeth, campanulate and somewhat enlarged and embracing the fruit. Corolla ·4″ long with very short tube, lobes stellate-pubescent. Stamens on the throat, anthers short oblong ·12″ long, scarcely exceeding the flattened filaments, not attenuate, opening by a short apical slit ultimately longitudinally dehiscent.

5. **S. giganteum,** *Jacq.*

A large handsome shrub 10–20 ft. high with white stellately mealy or tomentose more or less prickly stems and branches and large oblong-lanceolate acuminate leaves 6–10″ long, beautifully white beneath, white tomentose both sides when young glabrescent above. Fls. blue ·75″ diam. in dense corymbose panicles 1·5–3″ broad. Berries scarlet glabrous, ·25–·3″ diam.

Mayurbhanj, Meghasani, 3500 ft. ! Fl. March-April. Fr. May.

Base of leaves rounded in our specimens, cuneate in Madras ones, sec. n. about 12, oblique and attenuate. Petiole ·75—1·5″, rather slender, white with stellate tomentum as are the cymes. Pedicels slender, ·2–·5″. Calyx ·1–·15″ long with lanceolate lobes somewhat enlarged in fruit, white-tomentose. Corolla with lanceolate acuminate lobes white outside. Anthers yellow, elongate and attenuate above, with apical pores. Ovary puberulous. Seeds ·12″ diam. glabrous.

The tomentum is much finer and more mealy than in *S. verbascifolium*, in which the individual stellate hairs are very large.

6. **S. ferox,** *L.*

A large striking coarse herb or undershrub 2–4 ft. high with stellately woolly-tomentose and prickly stems, the stellate hairs large and stalked. Leaves elliptic-ovate, 5–10″ long and 4–6″ broad with large triangular teeth or lobes, prickly and densely lanate and with large stellate hairs beneath, and almost as much above. Flowers about ·6″ diam. in very short lateral, not axillary, cymes. Calyx with broadly ovate or triangular lobes densely hirsute. Corolla

purple (white, *Clarke*) ·5″ long, densely villous outside. Fruit globose 1″ diam. densely hirsute seated on the calyx, which is ·75″ diam. in fruit with broadly ovate lobes.

Purneah! Fl. Fr., Nov.-Jan.

7. **S. indicum,** *L.* Hanjad, Anjed, *K.*; Barhanta, *H.*; Baiakur, *Beng.*; Kantra, *Or.*

A stellately tomentose shrub or undershrub 3–6 ft. high with ovate or oblong sinuate or lobed leaves 3–6″ by 1–4″, grey- or dirty-white tomentose beneath, sub-scabridly stellate above, always more or less prickly on the nerves or mid-rib beneath and with lateral (or at first terminal) simple scorpioid cymes of blue, or sometimes nearly white, flowers ·75″ diam., 3–11 in a cyme on erecto-patent pedicels finally ·5–·7″ long. Berry yellow ·3–·35″ diam. exceeding the calyx which is not enlarged in fruit.

In every district, common in waste ground! Fl., Fr. nearly all the year.

Stems and branches with yellowish compressed often curved short prickles, young almost woolly. L. usually acuminate, but side lobes obtuse or rounded, base acute or uneven with the sides rectangular, rarely rounded or straight; sec. n. about 3–4 irregular. Petiole ·4–1·5″. Cymes usually very far from the axils with a very short peduncle or sessile, sometimes prickly, tomentose; pedicels thickened upwards. Calyx often prickly, tube very short, lobes ·15″, lanceolate, spreading in fruit. Corolla tomentose outside, lobes lanceolate. Fil. hardly any, anthers ·22″ long, attenuate from about half way up. Berry shining.

The berries are rubbed on the forehead for headache and are also used in Mayurbhanj for cough.

8. **S. torvum,** *Swartz.* Same vernacular names as the last. Bengar betahet, *S.*

A tomentose shrub 5-10 ft. high in many respects very similar to *S. indicum,* but usually taller and more erect with fewer more erect branches, leaves without prickles or with one only beneath near the base of midrib, cymes often bifurcate and denser and flowers always white, calyx never armed. Fruit ·5″ seated on the calyx which is ·35–·4″ diam. with lanceolate lobes.

Far less common than the last in our area, usually in the damper or cooler districts. Purneah! Plateaux of Chota Nagpur! Fl., Fr. most of the year.

Stems up to 1″ diam. Branches prickly. Leaves up to 9″ long, mostly 5–7″, sinuate or coarsely lobed, closely stellate tomentose beneath and with shorter sparser stellate hairs above. Cymes 2″ diam. or more. Fls. ·7–1″ diam., corolla stellately pubescent at the back or only towards the ends of the lanceolate lobes. Pedicels clavate in fruit, ·5–·7″ long. The fruit is said to be eaten.

9. **S. melongena,** *L.* Syn. S. esculentum, *Dun.*; S. insanum, *L.* (the wild form); Dhoko (the wild plant), Bengar (the cultivated plant), *K.*; Baigan, *H.*; The Brinjal or Egg Plant.

Erect herbaceous, closely covered with short prickles or, in some cultivated forms, completely unarmed. Young parts closely tomentose. Leaves large elliptic 4–7″ subentire, sinuate or shallowly lobed with rounded lobes. Flowers solitary or several in a cyme with the lowest only fertile, or in the wild plant all fertile, about 1″ diam. Calyx ·5–·75″ long in flower with elliptic or oblong or lanceolate lobes without very broad sinuses between, accrescent in fruit. Berry

glabrous white yellow or dark purple, 1″ or often of great size in cultivation.

Wild or feral, common in the dryer district! The cultivated form is grown everywhere in the rains. Fl. r.s. Fr. chiefly c.s.

De Candolle does not deal with this plant in his *Origin of Cultivated Plants* except in the general summary, where he ascribes its native country to India. *Sendtner* (teste *Clarke*) gives its home as Arabia.

Prickles flattened, straight or curved, ·2–·3″ only, often only a few straight prickles on the calyx and the rest unarmed. Petiole about 1″ long. Fls. often 6–9-merous. Fertile flower usually reflexed. Young calyx only toothed, older lobed half-way down and lobes quickly accrescent, often acuminate, tomentose, fruiting calyx sometimes ·9″ long. Corolla blue, up to ·7″ long, tomentose outside. Anthers scarcely attenuate, ·3″.

Roxburgh distinguishes three species, viz. (α) *S. melongena*, *Willd.* L. obliquely ovate, scollop-lobed. Fertile flowers solitary, drooping, barren in small racemes. Fruit oval. (β) *S. longum*, *Roxb.* (Kuli-baigun, *Beng.*). L. irregularly ovate, scolloped. Calyx sometimes armed. Fruit always cylindric. (γ) *S. insanum*, *Willd.* Perennial, armed (in poor soil). L. ovate sinuate downy. Peduncles 1–4-fld. Fruit oval to spherical, often white.

10. **S. xanthocarpum,** *Schrad. & Wendl.* Syn. S. diffusum, *Roxb.*, and including S. Jacquini, *Willd.*; Rangaini janum, *S.*; Ringni, *H.*; Kantakari, *Beng.*; Bejari, Ankaranti, *Or.*

A diffuse rather pretty herb, sometimes woody at the base, very copiously armed all over with straight yellow very sharp prickles ·5–·7″ long and many shorter ones. Leaves bright green with scattered stellate hairs, ovate, oblong or elliptic in outline, deeply lobed or sub-pinnatifid with the lobes or segments mostly again lobed or dentate. Flowers deep blue 1–1·3″ diam. in extra-axillary few-fld. cymes. Calyx ·15–·2″ long in flower with small linear lobes and usually very broad sinuses between, scarcely accrescent in fruit. Fruit globose, ·5–1″ diam., yellow, or sometimes white under shade, glabrous.

Roadsides and waste places, very common. Probably in all districts. Fl., Fr Dec.–June. Perennial.

Branches from the root usually dichotomous and flexuose, often angled by the decurrent petioles, which are 1–2″ long. Young parts sometimes stellate tomentose. Leaves with usually acute lobes. Calyx usually prickly, usually glabrescent. Corolla scarcely lobed. Berry often variegated green and white when unripe.

Roxburgh states that *S. diffusum*, *Roxb.*, is diffuse with the leaves oval deeply scolloped or lobed, with the lobes sometimes again scolloped or lobed, downy and prickly on both sides, while *S. jacquini*, *Willd.*, is creeping with angular stem. Leaves oblong-laciniate and nearly void of pubescence. Both are armed with long straight spines.

The fruits are eaten in curries, etc. Boiled in ghee they are given for cough and toothache.

11. **S. trilobatum,** *L.*

A very prickly climbing much-branched shrub with sharp recurved short compressed prickles and more or less deltoid or triangular irregularly lobed or sinuate leaves 1–2″ long. Flowers pretty, purple-blue, 1″ diam. with erect yellow stamens. Berry ·25–·3″ diam., globose, red.

Orissa, from Balasore! To Puri! Common on the rocky shores of the Chilka Lake! Fl., Fr. April-Jan., perhaps all the year round.

Leaves rather fleshy in our area, sometimes hastately 3-lobed, mostly obtuse, with scattered stellate hairs, a few prickles on the mid-rib. Petiole ·3–1″. Pedicels ·5–1′, solitary or in few-fld. extra-axillary or terminal cymes. Calyx small, sepals ·1–·15′. Corolla stellately pubescent outside. Anthers ·3″, gradually attenuate.

6. LYCOPERSICUM, *Miller.*

Pubescent herbs with pinnate leaves, pinnæ toothed or lyrate. Flowers mostly yellowish in few-fld. peduncled cymes. Sepals 5–6. Corolla rotate, limb 5–6-fid plaited in bud. Anthers long and narrow, gradually narrowed from base to apex, connivent in a cone, opening by slits. Ovary 2–many-celled. Seeds many, compressed, papillose, embryo curved.

Lycopersicum is sometimes included in *Solanum* as a section of that genus.

1. *L. esculentum*, *Mill.* Syn. *Solanum lycopersicum*, *L.* The Tomato.
Cultivated throughout the province. Native of South America.
The fruits in cultivation have often very numerous cells and placentæ.

7. DATURA, *L.*

Small trees, shrubs or coarse rank-scented herbs with simple often large, often sinuate lobed or deeply toothed leaves and large or very large solitary purple or white flowers. Calyx elongate tubular, 5-lobed, often 5-ribbed. Corolla tubular-funnel-shaped, sometimes somewhat zygomorphous. Stamens not longer than the corolla. Ovary 2- or spuriously 4-celled, style filiform. Fruit capsular (in the Indian species) or baccate, often spinous, 4-valved or irregularly breaking up. Seeds very many, compressed, rugose or dotted.

A. Flowers erect or inclined. Fruit capsular:—
Fls. 2·5–5″. Capsule ovoid erect regularly 4-valved . . 1. *stramonium*.
Fls. 5–7″. Fruit globose, irregularly breaking up . . 2. *fastuosa*.
B. Flowers drooping. Fruit baccate (*Brugmansia*) . . . 3. *suaveolens*.

1. **D. stramonium,** *L.* Syn. D. tatula, *Willd.*; D. Wallichii, *Dunal*; Datura, *Vern.*; The Thorn Apple.

A somewhat coarse annual 1–2·5 ft. with green or purplish stem, elliptic or ovate nearly glabrous leaves 2–5″ long, sinuate or lobulate, with large triangular teeth and suberect white or purple flowers 2·5–5″ long. Capsule ovoid, erect, 1·5″, prickly, splitting regularly at the top into 4 valves. Seeds black suborbicular, subcompressed, ·1–·13″ broad, minutely dotted.

Occasional in waste land! Ranchi ghats, Bishanpur! Fl., Fr. r.s. and c.s.
Leaves somewhat hispidulous on the nerves beneath. Petiole ·3–1″. Calyx 1·5″, narrowly tubular, 5-angled, teeth acutely lanceolate puberulous. Corolla lobes erect with cuspidate tips, so that it is usually only about 1″ diam. Peduncle ·25″ in fruit. Spines on fruit very sharp.

Var. *α* **tatula,** *Dunal.* Syn. D. tatula, *Willd.*

The flowers are usually only 3·5–4″, calyx 1·5″. Lobes of leaf nearly always acute. Prickles on capsule sharp, ·1–·3″ long. Common.

Var. *β* **Wallichii.** Syn. D. Wallichii, *Dunal.*

Stems angular. Branches and leaves farinose or pulverulent-pubescent. L. ovate 4–5″ sinuate-dentate with the teeth acute. Peduncle ·3–·5″. Calyx 2″ with the lobes short lanceolate or sometimes ·4″ long equal, tube pentagonal. Corolla 6″, yellowish white, 2·3″ diam. with caudate lobes ·2–·3″ long. Capsule as in *tatula*.
Bankipur, *Kew Herb.*! Fl. March.
This appears in size of flower to come near to the next species.
The true *D. stramonium* is a hill plant, larger and coarser and with bigger flowers, up to 6″ but the size of the flowers is rather variable. They are said always to be white while those of var. *tatula* are said to be always purple. This, however, is

not the case, and I have seen undoubted *tatula* in our area with white flowers. *De Candolle* considered that *T. tatula* came from America, and indeed it scarcely seems indigenous in our area.

The plant yields the well-known poison, and there used to be a belief in Chota Nagpur that the powdered seeds of this and the next species were used for half stupefying coolies whom it was desired to take against their will to the Assam tea gardens.

2. **D. fastuosa,** *L.* Same vernacular names.

More shrubby than the last, 3–5 ft. high with leaves 3–6″, sometimes entire or obtusely lobed or toothed, rarely teeth acute. Flowers purple or white 5–7″, rarely less, with a more spreading mouth to corolla than in *tatula*. Fruit inclined or nodding, quite globose, subbaccate, having a thick somewhat fleshy pericarp which breaks up irregularly and is armed with conical prickles, less pointed than in *tatula*. Fruiting peduncles up to ·8″.

In waste ground, frequent throughout the area! Fl. chiefly in the r.s. Sometimes (always?) perennial.

It has nowhere in the province the appearance of an indigenous plant. Large double and treble flowers are often seen in gardens.

Calyx 2·2–3″, lobes equal or unequal. Corolla-lobes sometimes ·5″ long.

3. **D. suaveolens,** *Humb. & Bonp.* Syn. Brugmansia suaveolens, *G. Don.*; Angel's Trumpet.

A very large handsome shrub, with entire ovate-oblong leaves and very large handsome drooping white flowers 9–12″ long frilled at the mouth. Calyx inflated glabrous angular. Fruit baccate, unarmed.

Frequent in gardens. A native of Mexico.

8. CESTRUM, *L.* Habrothamnus.

Trees or shrubs, sometimes sub-scandent, with entire, usually evergreen leaves and somewhat small or m.s. flowers in umbelliform or racemiform cymes, axillary or terminating short branches, sometimes panicled. Calyx tubular or campanulate, 5-toothed or -lobed. Corolla tubular or funnel-shaped with the tube long, limb 5-lobed comparatively short, spreading or reflexed. Stamens inserted in the middle of the tube, usually adnate to the tube, base hairy or thickened. Fruit a berry, few–1-seeded. Seeds large, with straight or only slightly curved embryo, albuminous.

A large genus of tropical America of which several species are frequently met with in Indian gardens, the most common being the following:—

1. **C. hirsutum,** *Jacq.* Mexican Jasmine; Lady of the Night.

Sparsely branched, branches hairy, leaves oblong acute tomentose beneath. Flowers greenish or becoming yellowish, remarkable for their sweet smell of a night.

The name is that given in horticultural gardens, the correct description (so far as it goes) being given for that species, but I believe that our common "Mexican Jasmine" is rather 2. *C. nocturnum, Murray*, in which the leaves are glabrous both sides, the corolla yellowish-green, very sweet of a night. *C. hirsutum* belongs to the section in which the corolla is attenuate below the ovary and embraces its stipes, globose round the ovary itself then gradually obconic-funnel-shaped. *C. nocturnum* on the other hand is obconic-funnel-shaped from the base, slender at the base, wide at the throat, but not embracing the ovary. I have kept no specimens.

9. NICOTIANA, *L.*

Erect, viscidly-pubescent herbs, rarely undershrubs, with entire or sinuate leaves. Flowers in cymose racemes or panicles, regular or somewhat zygomorphous. Calyx tubular or campanulate, 5-lobed. Corolla with long tube sometimes funnel-shaped above, and usually spreading 5-lobed limb. Stamens inserted low in the tube, usually one shorter than the others. Ovary 2–4-celled. Fruit a septicidal capsule, 2-valved, seldom 4-valved, valves 2-toothed or 2-fid. Seeds numerous small, scarcely compressed, embryo nearly straight in albumen. Natives of tropical America.

Corolla-tube narrow below, ventricose above, rosy . . . 1. *tabacum.*
Corolla-tube campanulate, yellowish, lobes obtuse . . . 2. *rustica.*
Corolla-tube linear, lobes acute, white or greenish-white . . 3. *plumbaginifolia.*
Corolla-tube linear, slightly swollen above, lobes obtuse white 4. *alata.*
Other species are sometimes found in gardens.

1. **N. tabacum,** *L.** Tamaku, *H.*; Sukul, *K.*; Tambali, *Mal. P.*

An erect glandular-pubescent herb with terete stem, large oblong-lanceolate acuminate sessile leaves, the lower semiamplexicaul and decurrent, and rosy or reddish pedicelled bracteate flowers 1·6–2″ long in many-fld., usually panicled racemes. Calyx ·4–·5″ oblong with lanceolate very acute unequal lobes. Corolla about ·7″ diam. with an inflated throat and acute spreading lobes, outside lanuginous. Capsule ·6–·7″, a little longer than the calyx, which is slightly accrescent.

Grown in all districts, usually in small highly cultivated plots of land close to the owners' houses, but more widely in the northern area, especially north of the Ganges, which has been said to be one of the most important tobacco areas in India. There is (or was) a tobacco farm at Pusa.

Howard (*loc cit.*) says that the seeds are brown and retain their vitality even under adverse conditions for several years.

2. **N. rustica,** *L.* Bilaiti Tamaku, Kalkatiya Tamaku, *Vern.*; Yellow-flowered Tobacco; English Tobacco.

Stem terete more or less branched from the base, leaves petioled broadly ovate obtuse, sometimes subcordate quite entire glandular, flowers greenish-yellow ·7–·8″ long, bracteate or ebracteate pedicelled, in terminal subpaniculate racemes. Calyx ·3″ cupular with very short triangular obtuse (long acute in one variety) lobes. Corolla tube broadly-tubular or subcampanulate ·5″ diam., pubescent-villous, twice as long as the calyx, limb ·5″ diam., glabrous with rounded or obtuse lobes. Capsule ·5″ subglobose obtuse, slightly exserted from the calyx.

Cultivated chiefly in Tirhut and Purneah but I have no exact notes of its distribution. Like the other it is grown in the cold season and the leaves removed or the plants cut about March. In Purneah it is said to be supplanting *tabacum*, being hardier and more quickly coming to maturity.

3. **N. plumbaginifolia,** *Viv.*

About 2 ft. high somewhat scabridly hairy, with spreading radical leaves and slender leafy stems. Leaves sessile entire, lower obovate-

* For an account of cultivated varieties see *Howard*, *Studies in Indian Tobaccos* (*Memoirs of the Dept. of Agriculture*).

spathulate or elliptic-ovate subobtuse and glabrescent, upper oblong-lanceolate semiamplexicaul acute hairy. Flowers very slender white or greenish-white, in terminal subpaniculate racemes. Calyx ·4–·5″ tubular 10-lined, with linear-lanceolate acuminate unequal lobes about as long as tube. Corolla salver-shaped with slender linear tube slightly widened above, usually greenish-white, about 1·5″ long or three times length of calyx, lobes pure white within, spreading, ovate, acute. Capsule ovate, glabrous, as long as the calyx, ·25″. Seeds minutely rugose.

An occasional weed, introduced but not, I believe, cultivated. Fl. April-May. Native of Mexico and the West Indies.

4. **N. alata,** *Link & Otto.* Syn. N. affinis, *nom. hort.*

A clammy glandular-pubescent herb about 2 ft. high with lower leaves obovate to oblanceolate, obtuse or rounded, with the base sessile and decurrent as wings on the stem, rarely some sub-petioled through reduction of the lamina, upper smaller subamplexicaul often oblong and acuminate. Flowers glandular-pubescent outside white, pedicelled, in terminal bracteate or ebracteate simple racemes with sometimes a few lower branches from the axils of the upper leaves. Calyx 1″, 10-ribbed with long-acuminate unequal lobes. Corolla-tube slender, 3–3·5″, slightly dilated above, greenish-white, limb somewhat oblique spreading pure white, 2–3″ diam. Capsule oblong.

Frequent in gardens. The flowers open in the evening and close next day and are beautifully fragrant at night. Native of Brazil.

FAM. 98. SCROPHULARIACEÆ.

Usually herbs (always in our species), sometimes semi-parasitic with opposite or whorled or alternate, often gland-dotted, simple exstipulate leaves. Flowers always more or less zygomorphic, solitary axillary or in simple or compound spikes or racemes or in axillary cymes or composite inflorescences. Calyx persistent 4–5-merous, valvate or variously imbricate in bud. Corolla sympetalous, 5–4-merous medianly zygomorphic, rarely actinomorphic, lobes alternating with the sepals, the upper two and lower three often respectively forming lips, imbricate never plicate in bud. Stamens rarely 5 perfect, usually 4, often didynamous, with the posterior rudimentary, or sometimes only 2, anthers 2–1-celled. Disc hypogynous, annular or unilateral. Ovary 2-celled with the cells median and placentation central axile; style simple or 2-lobed, stigma capitellate or on the margin or upperside of the style-lobes, one of which may sometimes be suppressed. Ovules many, rarely few, anatropous or amphitropous. Fruit a capsule, very rarely baccate (never in our species). Seeds usually numerous and small or fewer and larger, albuminous. Embryo straight or slightly curved.

The usually accepted separation of the series *Antirrhinoideæ* from the *Rhinanthoideæ* by the only positive character of the posterior petals or corolla-lobes being exterior in bud is most unsatisfactory and, I find, often misleading.

There may be other exceptions besides those indicated in the following key. Concerning *Dopatrium* I am somewhat doubtful. According to a field-note the large lateral lobes of the lower lip are exterior in bud, but more material is required. The æstivation in other genera requires further examination in the field with fresh specimens. The odd sepal is always median posterior and the odd petal or midlobe of lower lip is median anterior. But twisting of the pedicel apparently sometimes takes place in *Dopatrium*, bringing the large lower lobes uppermost in flower. The genus *Lindenbergia* scarcely seems to me to belong to the Tribe Gratioleæ.

I. Corolla 2-lipped or lobes 5, the 2 posterior lobes (sometimes connate in the upper lip) exterior in bud (exc. 8, 9 and 10). Genera 1–18 :—

A. All leaves alternate. Corolla rotate. St. 4 . . . . 1. *Celsia.*

B. All leaves or the lower only opposite (Antirrhinoideæ, Gen. 2–18) :—

1. Corolla 2-lipped, tube saccate or spurred, mouth closed :—

Corolla spurred . . . . . 2. *Linaria.*

Corolla broad and saccate at the base . . . . . 3. *Antirrhinum.*

2. Corolla neither saccate nor spurred, mouth open :—

a. Cor.-tube very long and narrow. Fls. cymose, red 4. *Russelia.*

b. Cor.-tube not very long. Fls. axillary or racemose :—

i. St. 4 didynamous, anthers finally 1-celled :—

Viscid herb. Lower leaves pinnatifid . . . 5. *Sutera.*

ii. St. 4 or 2, usually didynamous, anthers 2 or all 2-celled (Gratioleæ, Gen. 6–16) :—

† Anther-cells not divaricate or separated :—

! Stamens 4 perfect, included in the tube :—

Leaves mostly radical. Fls. in subsecund racemes. Sepals often broad . . . . 6. *Mazus.*

L. cauline. Fls. not secund. Upper sepal often very broad . . . . . 7. *Herpestis.*

L. radical and cauline. Fls. not secund. Sepals equal, narrow . . . . . 8. *Mimulus.*

!! St. 2 only perfect, staminodes 2 minute included :—

Slender marsh herb with fls. in distant pairs . . . . . 9. *Dopatrium.*

†† Anther-cells, if perfect, divaricate or separate :—

! St. 4 perfect, all included in the tube :—

* Capsule 2-valved. Lower lip exterior in bud . . . . . 10. *Lindenbergia.*

** Capsule 4-valved :—

§ Sep. unequal, one anther-cell often imperfect . . . . . 11. *Adenosma.*

§§ Sep. equal, all anthers with 2 perfect cells :—

Erect viscid-pubescent herbs. Seeds ellipsoid . . . . . 12. *Stemodia.*

Marsh herbs, habit various. Seeds angular . . . . . 13. *Limnophila.*

!! St. 4, 2 perfect in the tube, 2 in the throat perfect or reduced to staminodes :—

* Calyx winged. St. 4 perfect. Fls. often showy . . . . . 14. *Torenia.*

** Calyx not winged. St. 4 or 2 perfect. Fls. small :—

Leaves with a single midrib or pennineved . . . . . 15. *Vandellia.*

Leaves 3-5-nerved from base . . . 16. *Lindernia* (*Ilysanthes*).

ii. St. 2, anthers 1-celled, staminodes 0. Minute marsh herbs with minute axillary fls. (Limoselleæ) :—

Calyx tubular, angled, 5-fid. . . . . 17. *Microcarpæa.*

Calyx not angled, 3–4-lobed . . . . . 18. *Glossostigma.*

II. Corolla 2-lipped or lobes 4 or 5; 2 lateral or anterior exterior in bud (Rhinanthoideæ. *Vide* also 8, 9 and 10):—
A. Corolla sub-rotate, 4-merous:—
Stamens 2 . . . . . 19. *Veronica.*
Stamens 4 . . . . . 20. *Scoparia.*
B. Corolla 5-merous with short broad tube, or tube ventricose above:—
1. Calyx spathaceous . . . . . 21. *Centranthera.*
2. Calyx not spathaceous, campanulate:—
Anthers with one cell stipitate and empty . . . 22. *Sopubia.*
Anther-cells parallel, both polleniferous . . . 23. *Alectra.*
C. Corolla 5-merous, tube long slender:—
Cor.-tube not abruptly incurved, lobes equal . . . 24. *Buchnera.*
Cor.-tube abruptly incurved, limb distinctly 2-lipped, lobes of upper lip small . . . . . 25. *Striga.*

The family includes many well-known garden plants often grown in the province in the cold season and not described here; such are *Angelonia*, *Calceolaria*, *Maurandia* (a climber), *Collinsia*, *Pentastemon.*

1. CELSIA, *L.*

Erect, tomentose or woolly, usually tall and often unbranched herbs with all the leaves alternate, and yellow, rarely white or red, flowers in simple or panicled terminal racemes or spikes. Calyx 5-lobed or -partite, lobes imbricate. Corolla rotate, regular or slightly zygomorphic, lobes 5 broad, upper exterior in bud. Stamens 4, filaments hairy or glabrous, unequal, anthers transverse or oblique, cells confluent. Style top dilated, stigma simple. Capsule oblong or ovoid, septicidal. Seeds numerous, small rugose.

1. C. coromandeliana, *Wall.*

An erect hairy-pubescent herb 2–3 ft. high, unbranched except towards the inflorescence. Radical leaves lyrate-pinnatifid, cauline sessile ovate or oblong-ovate, toothed, passing into bracts upwards. Flowers yellow ·5″ diam. in simple or panicled racemes 6–10″ long. Capsule sub-globose ·25–·3″ long glabrous glandular.

Not common generally. Champaran, a weed in fields! Chota Nagpur, occasional in river beds! Kalahandi, near rivers! Fl., Fr. Feb.–May. Annual.

Lower leaves 2–4″ with a large terminal usually oblong obtuse toothed lobe. Flowers with pedicels ·25–·3″ long, bracts ovate, very small at top of raceme. Sepals oblong or ovate. Filaments hairy. Seeds very small oblong-grey, longitudinally grooved and rugose between the grooves.

2. LINARIA, *Juss.*

Herbs with usually opposite (alternate in our species) leaves, sometimes whorled below or alternate above. Flowers axillary solitary or racemose or spicate, ebracteolate, 2-lipped. Sepals imbricate. Corolla spurred anteriorly, upper lip erect of 2 more or less connate petals, lower spreading of 3 more or less connate petals, throat usually closed by a tumid palate. Stamens 4, didynamous, ascending, included; anther-cells distinct, parallel. Stigma minute. Capsule ovoid or globose, each cell or the anterior only opening by an apical pore. Seeds numerous.

Spur shorter than the corolla-tube:—
Leaves nearly glabrous . . . . . 1. *ramosissima.*
Softly hairy all over . . . . . var. *pubescens.*
Spur longer than the corolla-tube. Whole plant hirsute . . 2. *cabulica.*

1. **L. ramosissima,** *Wall.* Indian Ivy-leaved Toad Flax.

A pretty little trailing, rarely suberect, plant with slender stems many inches long spreading from the rootstock and small leaves, many of which are ivy-shaped and 5- or 6-7-lobed, others on quicker growing shoots elliptic entire or scarcely lobed. Flowers small yellow on capillary pedicels exceeding the leaves. Capsule ·1–·15″, globose-ovoid, opening on one side by a valve, on the other by a sub-apical pore.

Patna! "Common along the Ganges above Patna," *Kew Herb.* "In most of the provinces," according to *Beng. Pl.*, but this is probably in consideration of its general distribution and is not borne out by the material to hand. There are no specimens from Behar and Orissa in the *Cal. Herb.*, so that it is at any rate exceedingly rare in our area. Fl. Oct. and c.s. Fr. May–June.

Stems slender pubescent and glabrescent. Leaves in the Patna plant glabrous. The leaves are very variable, as also is the hairiness. Those on the plant in the hot season are often only ·15–·3″ long, but those produced in the rainy season 1″ or sometimes even 2″ long. Petioles ·2–·4″ slender. Pedicels ·4–1·5″. Calyx ·12″, nearly glabrous, sepals lanceolate slender. Corolla ·2–·3″, tube puberulous, spur short, ·08″. Seeds minutely spinulose.

2. **L. cabulica,** *Benth.*

Habit similar to the last but more rigid, always softly hirsute. Leaves ovate sub-hastate and lobed or upper lanceolate sagittate. Pedicels longer than the leaves, spur longer than the corolla-tube, seeds scabrous.

Shahabad, Rhotas cliffs, *J.D.H.*!

But I take the Rhotas specimen to be also *L. ramosissima*. The stems, petioles, calyx and corolla are minutely pubescent only whereas *L. cabulica* is hirsute. The corolla is ·2″ with spur ·08″ only.

The two species are very closely allied, and as regards the length of the spur while *Bentham* says that is longer than the corolla-tube in *L. cabulica*, *Bosssier* states that it is shorter. *Prain* also (*Beng. Pl.*) gives *L. incana*, *Wall*, from W. Behar. The above specimen from Rhotas was at first so named, but I can find no others. The species is a Himalayan one.

Antirrhinum majus, *L.*, the common Snapdragon, is often grown in gardens. It is a native of southern Europe and northern Africa.

4. RUSSELIA, *Jacq.*

Shrubs or undershrubs with angular branches and often pendulous branchlets, opposite or whorled leaves often minute or squamiform. Flowers scarlet, in dichotomous cymes, or peduncles 1–3-fld. only. Calyx 5-fid. Corolla tubular. Stamens 4 fertile, subdeclinate at base, anther-cells divaricate at length confluent; fifth stamen rudimentary, minute. Capsule subglobose, septicidal, valves 2-fid. Seeds many, ovoid, mixed with long hyaline caducous hairs which arise from the placentæ.

Natives of Mexico.

Glabrous. Leaves on branchlets squamiform. Peduncles 1-3-fld. 1. *juncea.*
Pubescent. Leaves all developed. Peduncles short many-fld. . 2. *rotundifolia.*

1. **R. juncea,** *Zuccar.*

A very beautiful plant 3–4 ft. high with rush-like branches and upper leaves reduced to scales, though in the rains those on the new shoots are well developed linear, lanceolate or ovate. Flowers ·5″

long, very numerous scarlet on 1–3-fld. peduncles borne in great profusion on the drooping branches.

Very common in all gardens. Fl. most of the year.

2. **R. rotundifolia,** *Car.* Syn. R. floribunda, *Humb. B. & Kunth.*

Erect, 2–4 ft. Leaves well-developed orbicular, 2–4″, sessile, pubescent beneath. Fls. crimson-scarlet in close axillary cymes and very numerous.

Also a very handsome plant and common in gardens. Fl. most of the year.

5. SUTERA, *Roth.*

Viscid-pubescent herb with lower leaves opposite pinnatifid, upper alternate. Flowers small axillary and in terminal racemes, ebracteolate. Sepals narrow. Corolla-tube slender, not dilated above, lobes 5, small, 2 upper outer in bud and rather smaller. Stamens 4 didynamous, included, filaments slender. Style short, stigma obtuse or notched. Capsule ovoid-oblong, septicidal, valves 2-fid. Seeds many, testa pitted.

1. **S. glandulosa,** *Roth.*

Erect or spreading with numerous branched stems 6–10″ long, the whole plant glandular-viscid and collecting much dirt. Leaves somewhat resembling those of a *Pedicularis,* closely multi-pinnatifidly lobed, ·25–·5″ long, lobes toothed. Sepals ·12–·14″ equal with glandular dots. Corolla-tube exceeding the calyx, with small spreading limb, white or purplish with yellow. Capsule ·2″ ellipsoid-oblong.

River-sides and wet soil. Behar, *J.D.H.*! Fl., Fr. Jan.–March.

6. MAZUS, *Lour.*

Small herbs, often with runners. Leaves rosulate or opposite below, opp. or alternate above. Flowers in terminal subsecund racemes with bracts and bracteoles minute or 0. Calyx campanulate 5-fid. Corolla-tube short, upper lip erect 2-fid, lower larger spreading 3-fid, throat with a 2-lobed palate. Stamens 4, didynamous, anther-cells contiguous, diverging, not confluent. Stigma 2-lamellate. Capsule included, globose or compressed, obtuse, loculicidal, valves entire. Seeds numerous, very minute, ovoid.

1. **M. rugosus,** *Lour.*

A little herb with prostrate ascending leafy, usually pubescent or hairy branches and erect scapiform racemes. Leaves mostly radical obovate-spathulate, 1–3″ long, tapering into a short petiole, those on the branches smaller. Flowers ·25″ pale-blue or white. Calyx equally 5-lobed, lobes ·12″ in flower, oblong or ovate-lanceolate, becoming much enlarged in fruit, flat and spreading. Corolla upper lip concave with short linear lobes, palate brown-spotted and with clavate hairs. Capsule subglobose.

In wet or damp shady places. Purneah! Champaran, *Hieronymus*! Chota Nagpur, Singbhum, near rivers and on the plateaux, not uncommon! Fl. practically all the year.

Leaves more or less sinuate, crenate or dentate. Scapes 1·5–8″ high, sometimes with alternate leaves on the lower part. Pedicels ·1–·3″ or even ·75″ in fruit. Calyx in fruit ·3–·4″ long and ·5″ diam. Two lower stamens exserted, two upper in the tube, anthers conniving in pairs.

7. HERPESTIS, *Gaertn. f.*

Glabrous, often gland-punctate, herbs with often narrow entire or toothed, or submersed multifid, leaves. Flowers axillary or racemose, yellow blue or white, pedicels bracteolate or not. Sepals 5, sepals unequal, upper often large. Corolla with cylindric tube and spreading lips, upper outer in bud, notched or 2-lobed, lower 3-lobed. Stamens didynamous, included, anther-cells contiguous, distinct. Style dilated at top and 2-lobed or entire. Capsule 2-grooved, valves 2 or 4, separating from an entire columnar placenta. Seeds many very minute.

Slender, creeping. Flowers peduncled . . . . . 1. *monniera.*
Stout, erect. Flowers sessile . . . . . 2. *Hamiltoniana.*

1. H. monniera, *H. B. & K.*

A creeping sub-succulent herb with narrowly obovate-oblong or spathulate entire sessile obtuse leaves ·3–·75″ long and purplish-white or pink flowers ·3–·45″ long on pedicels ·25–·5″. Calyx lobes very unequal, 2 larger ·17″ in flower enlarging to ·25″, ovate-oblong. Capsule ovoid acute included.

A common marsh plant, but badly represented in herbaria. Behar, *J.D.H.*! Singbhum, common! Manbhum, *Camp.*; Chilka Lake, *Cal. Herb.*! Fl., Fr. June-Dec.

Glabrous, stems up to 12″. Leaves with very obscure nerves. Peduncles sometimes lengthening to 1·3″ in fruit and deflexed. Bracteoles small. Corolla ·3″ diam.

2. H. Hamiltoniana, *Benth.*

A herb 6–12″ high with 4-angled stems, linear-lanceolate leaves, 1-1·5″ long and sessile flowers ·17″ long. Capsule globose surrounded by the very unequal sepals, of which the upper is broadly ovate acute ·25″ long and nearly as broad, lateral ovate or lanceolate, and the two inner linear-oblong shorter than the capsule.

Marshy ground. Singbhum! Fl. Sept.–Oct. Fr. Nov.–Dec.

Glabrous, erect. Leaves ·12–·17″ broad, tapering at base. Bracteoles setaceous, shorter than capsule. Corolla scarcely longer than the calyx in flower, upper lip 2-fid beyond the middle. Fruiting calyx somewhat venous. Capsule 4-valved. Seeds cylindric, truncate.

8. MIMULUS, *L.*

Erect or prostrate, usually glandular, herbs with opposite leaves and solitary axillary or subracemose irregular flowers. Calyx tubular, 5-angled and -toothed. Corolla 2-lipped, upper lip 2-, lower 3-lobed, throat usually with a swollen 2-lobed palate. Stamens 4, didynamous, anther-cells divergent subconfluent or confluent at the tips. Stigma 2-lamellate. Capsule compressed, loculicidal, valves separating from the placentiferous septum. Seeds numerous, minute, oblong.

Erect, leaves sessile, narrow oblong . . . . . 1. *gracilis.*
Creeping, leaves petioled, orbicular . . . . . 2. *orbicularis.*

1. **M. gracilis,** *Br.*

An erect herb 6–20″ high with compressed and angular stems grooved each side, sessile narrow-oblong suberect or erect glabrous leaves, lower 1–2″ long, gradually shorter upwards, gland-dotted beneath, base 3-nerved. Flowers white or pinkish ·5″ long, on slender stalks elongating to 1″ or more. Capsule oblong compressed as long as the calyx.

Purneah! Santal Parg., Banks of Ganges, *Kurz*! Singbhum, Ranchi, and Palamau, near streams in the hills, also banks of rice-fields in the plains in r.s.! Fl., Fr. April-Jan.

Leaves sometimes slightly toothed, widest in middle, obtuse or acute. Calyx ·25″, lobes about one-fourth tube, keeled, acute. Corolla scarcely exserted, side lobes of lower lip external in bud, then the two short upper lobes, the middle lobe of lower lip innermost and inflected, side-lobes spurred, middle anterior lobe broadest papillose, calli of throat brown-spotted. Two lower stamens longest, all with 2 large reflexed anther-cells confluent at tip.

2. **M. orbicularis,** *Benth.*

Collected by *Hooper* on the shores of the Chilka Lake, but just outside our boundary.

Creeping with petioled orbicular fleshy nerveless entire leaves. Corolla ·5-·6″. Capsule ·3′ exserted.

Several species are cultivated. *M. moschatus, L.*, has a delicate smell and is usually called "musk." It is native of America.

9. DOPATRIUM, *Hamil.*

Very slender glabrous marsh herbs with few opposite leaves, upper remote and minute. Flowers small pink or purple axillary or in terminal pseudo-racemes, ebracteolate. Calyx 5-fid. Corolla-tube slender below, wide towards the throat. Upper lip outer 2-fid, lower 3-lobed. Stamens 2 upper perfect included, anther-cells parallel distinct, equal; staminodes 2 minute. Style short, stigma 2-lamellate or sub-peltate. Capsule loculicidal, valves placentiferous. Seeds very minute, tubercled.

1. **D. junceum,** *Ham.*

A slender herb with erect succulent stems which bear small opposite distant pairs of leaves or are quite leafless and end in a slender raceme of distant opposite pairs of small rose-coloured flowers ·2–·25″ long on slender pedicels ·5″. Bracts small oblong rounded at tip, ·05″.

Marshy places, not very commonly collected. Singbhum! Manbhum, *Camp.*! Ranchi! Also very common in rice-fields, etc., in the Jalpaiguri district bordering on Purneah, where it is no doubt common and probably is found in all districts. Fl., Fr. Aug.–Oct.

Stems striate 6–12″. Leaves oblong obtuse ·5–2″ at base of stem, parallel-nerved, upper reduced to bracts. Calyx ·06″ very thin, tubular, teeth about half as long as tube, lanceolate, black-tipped. Corolla glandular-puberulous, upper lip about ·1″ broad. Capsule brown glabrous ·08″ diam., polished, slightly grooved over the top.

The structure of the stem is peculiar; the striæ correspond to radiating septa within, which divide it up into about 10 separate cavities.

10. LINDENBERGIA, *Lehm.*

Herbs, sometimes woody at base. Leaves opposite or the upper alternate, toothed. Flowers axillary, spicate or racemed, yellow,

bracteate, ebracteolate. Calyx campanulate, 5-fid. Corolla with cylindrical tube, upper lip short broad, innermost (according to *F.B.I.* it is the *outer*; perhaps it varies in different species) in bud, notched or 2-fid, lower larger 3-lobed, spreading, base with two plaits. Stamens 4 didynamous, included, anther-cells separate, stipitate, all polleniferous. Capsule 2-grooved, loculicidal with entire valves separating from the placentiferous axis. Seeds, numerous minute.

Tufted. L. sub-sessile, mostly under ·5″ . . . . . 1. *polyantha.*
Erect, not tufted. Leaves ·5–1·5″, membranous, with slender pedicels . . . . . 2. *urticæfolia.*

1. **L. polyantha,** *Royle.*

A tufted herb with usually several erect, sub-erect and diffuse, rarely solitary glandular hairy stems 4–12″ long. Leaves nearly uniform, small, broadly ovate or elliptic, crenate, under ·5″, rarely ·75″ long with very short petioles, upper usually somewhat narrower and bearing subsecund solitary flowers in their axils. Flowers very shortly pedicelled yellow ·5″ long. Stamens, two lower longer, all with purple anthers and distinct cells pendulous from the 2-fid connective. Capsule ovoid ·25″ with a laterally compressed very acute tip, slightly pubescent.

On old walls. Purneah! Monghyr, *Lockwood*! Fl., Fr. c.s.

The tufted appearance is sometimes due to single stems copiously branched at the base. Bracteoles 0. Calyx campanulate ·25″ with long lax white hairs, lobed about one-third way down, lobes oblong rounded. Corolla narrow erect, tube exceeding the calyx, lower lip ·12″ broad, lobes rounded with reflexed margins, upper lip lanceolate slightly hooded but with 2-lobed obtuse tip reflexed, both lips hirsute within, palate gibbous, brown dotted. Longer stamens finally exserted from the sides, one anther-cell higher than the other. Seeds ellipsoid with a loose delicately dotted testa, dots raised very close.

2. **L. urticæfolia,** *Lehm.*

An erect herb from 1″ high with simple stem to 8″ high, branched, and hairy or nearly glabrous, not tufted. Leaves ovate serrate ·5–2″, lower larger with slender petioles, upper smaller or passing into bracts. Flowers small yellow about ·3–·4″ long, 1–2 in the axils, shortly pedicelled. Anthers all perfect, cells distinct, one stipitate. Capsule ·2″ slightly exserted from the calyx, hairy, beaked.

Rare. On walls and banks. Shahabad (Rhotas), *Kew Herb.*! Parasnath! Ranchi; Pitorea, *Wood*! Fl., Fr. end of r.s. and c.s.

Leaves larger and more membranous than in *L. polyantha*. Petiole ·2–·75″ long. Fls. secund. Calyx ·12–·15″ with 5 broad obtuse lobes, lobes recurved. Corolla sparsely hairy. Ovary pubescent.

11. ADENOSMA, *Br.*

Glandular herbs with opposite rugose crenulate leaves and flowers axillary or in leafy spikes, racemes or heads. Sepals 5, often sometimes greatly enlarged in fruit. Corolla-tube cylindric, upper lip erect entire or notched, lower spreading 3-lobed, base not plaited. Stamens didynamous included; anther-cells distinct, stipitate, one cell empty or of the two anterior anthers only. Style dilated at the

tip, winged below the entire or 2-lamellate stigma. Capsule 2-grooved, loculicidal and septicidal, 4-valved. Seeds many, minute, reticulate.

1. **A. capitatum,** *Benth.*

An erect, glandular-villous herb 1–2 ft. high with numerous opposite and decussate ascending branches gradually shorter upwards and short-petioled ovate or ovate-oblong serrate leaves 1–2″ long. Flowers blue in dense cylindric or ovoid terminal bracteate heads, a few also sometimes axillary in the uppermost leaves. Usually deep brown when in fruit with capsules narrow-ovoid, thinly coriaceous and glistening, divided septicidally into two halves and then loculicidally dehiscent, closely invested by the calyx.

Damp meadows, grass jungles, etc. Purneah, common! Chota Nagpur, frequent! Fl. r.s. Fr. c.s.

Somewhat with the habit of the English *Prunella vulgaris*. Leaves often reflexed, base more or less cuneate, tip obtuse or subacute, petiole up to ·3″ long. Heads ·5–·75″ or sometimes much longer, with an involucre of leaves or bracts, bracts between the flowers linear and hardly exceeding them. Calyx ·25″, sepals lanceolate, upper largest. Seeds smooth.

12. STEMODIA, *L.*

Hairy or glandular aromatic herbs. Leaves sometimes whorled. Anther-cells all polleniferous. Seeds most minute, ellipsoid. Other characters as in *Adenosma*.

1. **S. viscosa,** *Roxb.*

A herb 6–18″ high resembling some of the larger semi-terrestrial *Limnophilas*, with leafy erect branched ridged stems, and viscidly pubescent all over. Leaves sessile oblong serrate or serrulate 1–2″ long, or rarely all small and under ·5″, with amplexicaul cordate or auricled base. Flowers violet ·4″ long, long-pedicelled in nearly all the leaf (or bract) axils. Pedicels ·5–·6″ or upper ·25″ only in small plants. Calyx ·17–·18″ with narrow lanceolate sepals. Corolla-tube ·25″, limb ·2″ diam. Capsule as long as calyx acuminate.

Behar, near the Sone River, *Griffith*!

13. LIMNOPHILA, *Br.*

(Ambulia, *Lam.*, in the *Nat. Pflanzenfamilien.*)

Herbs of very various habit, often aquatic, aromatic and with glands (visible as dots) in the leaves which may be submersed and multifid, or whorled, or opposite and toothed. Flowers axillary, solitary or racemose or spicate, bracteolate or not. Sepals narrow, subequal or the posterior larger. Corolla-tube cylindric, upper lip outer in bud, suberect, entire or 2-fid; lower spreading, 3-fid, base not plaited. Stamens 4 didynamous, included, anther-cells usually separate and stipitate. Style deflexed at the tip, stigma shortly 2-lamellate. Capsule ovoid or oblong, septi- and loculi-cidal, valves bearing the placentiferous septa. Seeds angular reticulate (*F.B.I.*, I have not always found this).

The species are variable, the habit and foliage much depending on the depth of the water, etc., in which they grow. I think that nos. 2 and 3 are possibly forms of one species, 5 and 6 of another, and nos. 7–10 of another variable species.

I. Leaves not whorled, never pinnatifid nor with capillary segments. (Mostly stout erect species with small diffuse forms in 2 and 3):—
  A. Flowers mostly in heads:—
    Stems stout 1–2 ft. L. 2–3·5″ long . . . . . 1. *Roxburghii.*
  B. Flowers solitary axillary or becoming spicate or racemose:—
    1. Flowers sessile or very shortly pedicelled:—
      a. Leaves with only one primary nerve (midrib):—
        Glabrous or nearly so. Sec. n. scarcely visible . . 2. *conferta.*
        Pubescent. Sec. n. visible. Fls. often shortly pedicelled . . . . . 3. *diffusa.*
      b. Leaves with 3–5 primary nerves:—
        Erect or decumbent, glabrous below, glandular-pubescent above . . . . . 4. *hypericifolia.*
    2. Flowers with pedicels exceeding the calyx:—
      Erect, glabrous. Flowers ·35–·6″ racemed . . . 5. *gratissima.*
      (See also *hirsuta*, var.).

II. Leaves some or all whorled (rarely all opposite in 5 and 6), often pinnatifid or capillaceo-multifid:—
  A. Leaves 1-nerved, no pinnatifid leaves. Fls. pedicelled. Fruiting calyx striate:—
    Glabrous. Flowers racemose . . . . . 5. *gratissima.*
    More or less hairy. Fls. more cymose (often in 3's) . . 6. *hirsuta.*
  B. Pinnatifid or capillaceo-multifid leaves always present, opposite leaves, if present, usually 3-nerved. Fruiting calyx membranous, not striate:—
    1. Fls. with pedicels longer than calyx:—
      Slender, glabrous or puberulous. Fls. pale-coloured . 7. *gratioloides.*
      Stouter. Pubescent or hirsute. Fls. purple or bluish . 8. *racemosa.*
    2. Flowers sessile:—
      Habit of 7. Multifid leaves 0. Stems pubescent . . 9. *sessiliflora.*
      Stouter. Multifid leaves present. Stems glabrous . 10. *heterophylla.*

1. **L. Roxburghii,** *G. Don.*

Stems stout 1–2 ft. high from a creeping base, leaves opposite elliptic or ovate 2–3·5″ long, narrowed at base into a petiole ·25–1″ long, crenate-serrate or crenulate, sec. n. 7–10 strong, running to close within the margin. Flowers blue-purple with yellow mouth, sessile in dense axillary heads. Capsule compressed oblong, grooved, ·2–·25″ long.

Along streams, usually under shade. Monghyr, *Ham.*! Singbhum! Manbhum, *Camp.*! Ranchi, *Clarke*! Hazaribagh, *Cal. Herb.*! Fl. r.s. Fr. Nov.–Dec., old inflorescence remaining up to Feb.

Aromatic; pubescent or glabrous, petioles forming lines at the thick nodes. Leaves punctate beneath, obtuse or subacute. Heads globose or oblong, sessile or shortly peduncled with conspicuous bracts to the flowers. Calyx hairy or pubescent, ·3″ long (measuring along longest sepal), lobes acuminate, with strong midrib. Corolla ·3″. Seeds oblong angled, minutely dotted rather than reticulate.

2. **L. conferta,** *Benth.*

A scented nearly glabrous herb, variable in size, small and diffuse 4–8″ or sometimes erect and up to 18″. Leaves ·2–·3″ long only or ·75–1·5″ long, always elliptic-lanceolate or elliptic-oblong sessile or subsessile, conspicuously punctate (gland-dotted) beneath, serrate or obtusely serrate, with obtuse tip and when fresh appearing nerveless except the mid-rib. Fls. purple ·3–·5″ long, arranged in axillary

loose bracteate spikes or solitary axillary; bracteolate. Calyx ·12–·2″, glandular pubescent with linear acuminate lobes. Capsule ·08–·1″ ellipsoid shining papery or membranous, falling before dehiscing or very tardily dehiscent. Seeds short oblong angled, shining.

Rice fields and watery places. Purneah, common! Singbhum! Manbhum, *Camp.*! Ranchi, *Clarke*! Sambalpur! Fl., Fr. c.s.

Leaves narrowed at the base; petiole occasionally ·25″ long, often 0. Spikes sometimes up to 2″ in length and compound with lowest flowers sometimes shortly pedicelled, rhachis pubescent, bracts opposite or alternate, bracteoles shorter than the calyx, linear. Calyx deeply 5-fid, striate in fruit. Corolla tube nearly straight, slightly inflated below, 2 upper lobes exterior in bud, purple, throat yellowish and tube hairy within, lobes semi-orbicular.

3. **L. diffusa,** *Benth.*

Scarcely appears to be more than a variety of *L. conferta*, with pubescent more strongly nerved crenate-serrate leaves and often racemose flowers or flowers in short axillary cymes or long spikes or racemes.

Singbhum! Purneah, *Kurz*! Fl., Fr. c.s.

4. **L. hypericifolia,** *Benth.*

Erect, or decumbent below, 6–18″ high, glabrous except the gland-pubescent inflorescence. Leaves opp. entire or denticulate, ·75–1·5″ long, half-amplexicaul, elliptic- or ovate-oblong, with 1–2 nerves from the base each side of the mid-rib. Flowers ·5–·6″ long, rose-purple, sessile in the axils of the floral leaves or bracts which are opposite or alternate. Calyx ·2–·25″, ribbed, with stalked glands, lobes linear or lanceolate (ovate, *F.B.I.*) acuminate, membranous in fruit. Capsule broadly elliptic.

Watercourses below Neterhat, 3000 ft. Palamau! Fl. Oct.

It differs from the description of the species in the *F.B.I.* by being glandular pubescent above and by the calyx-lobes being lanceolate, not ovate. Leaves punctate, rather thick, base broad, obtuse. Bracts with sub-cordate base, leaf-like but usually only ·4–·5″, very glandular. Bracteoles narrowly linear-subulate ·2″ long. Calyx-lobes with membranous margins. Corolla densely glandular, upper lip exterior in bud, posterior lobe largest broadly oblong, side lobes small rounded.

5. **L. gratissima,** *Blume.*

An erect glabrous species also a good deal resembling *L. conferta*, with opposite or some 3–4-nately whorled, scarcely petioled, very punctate, oblong leaves 1·5–2·5″ long, half-amplexicaul and often attenuate at the base. Flowers ·35–·6″ long in axillary and terminal many-fld. racemes with pedicels ·3–·4″ long. Calyx ·2–·25″ long, striate with veins. Capsule ·2″ oblong acute.

Watery places. Hazaribagh, *Clarke*! Fl. Oct.

Leaf margin thickened, sharply serrate to shallowly serrulate. Bracteoles acicular, ·04–·08″.

6. **L. hirsuta,** *Benth.*

A pretty marsh herb with hollow purplish usually hairy stems 1–2 ft. high, opposite and 3–4-nate oblong or elliptic-oblong gland-dotted serrate leaves about 1″ long, sessile or narrowed into a short petiole, and many 1–2-nate axillary pedicelled flowers ·5″ long, sometimes cymose or panicled at the top of the stem. Calyx ·27–·3″ long, thinly

glandular-pubescent or hirsute, lobes narrowly lanceolate acuminate, striate in fruit. Corolla-tube exserted reddish, lobes violet small ·15″, expanded corolla ·45–·5″ diam. Capsule broadly ellipsoid.

Purneah! Ranchi, *Clarke*! Fl., Fr., c.s.

Stems hollow, terete, sometimes decumbent below. Leaves with broad amplexicaul base below, aromatic, widest about the middle. Sec. n. 3–4 faint unbranched. Floral leaves exceeding the slender ·3–·5″ pedicels, bracteoles one-third the calyx, filiform. Upper corolla-lobes rounded, lateral broadly oblong ·15″, anterior similar.

Var. **Clarkei.**

Glabrous with much broader elliptic leaves. This is placed under *L. hirsuta* by *Hooker*. The leaves are opposite and it is difficult to distinguish it from *L. gratissima* except by the more cymose inflorescence and, *Hooker* says, by the more orbicular capsule. Ranchi, *Clarke*.

7. **L. gratioloides,** *Br.*; Karpur, *Beng.*; Nanha Hemcha, *S.*

A common small marsh plant much resembling *L. sessiliflora* in habit, aromatic puberulous and glandular all over, or glabrous, with pinnatifid whorled leaves and pedicelled white or pinkish axillary flowers, the pedicels of which elongate in fruit, attaining ·7–1″ in length. Fls. ·4–·5″. Calyx with linear sepals ·15–·2″, in fruit hemispheric with broader acuminate sepals, midribs usually evident, but not striate.

Marshes, tanks, etc. N. Bengal, *Kurz*! Monghyr! Gya, *Cal. Herb.*! Manbhum, *Camp.*! Singbhum, common! Sambalpur, *Griff.*! No doubt therefore in all districts. Fl., Fr. Sept.–Feb.

Lower leaves often capillaceo-multifid, uppermost rarely entire. Some of my specimens have 12–14 leaves in a whorl, cuneate-pinnatifid, ·5″, submersed much longer and multifid. Calyx glabrous or somewhat pubescent. Cor. white or pale-purple; I have never seen it dark purple in this species. Bracteoles linear. Fruiting sepals occasionally 3-nerved. Capsule broadly ellipsoid, ·5″.

8. **L. racemosa,** *Benth.*

Robust below and stems 10″–2 ft. (*F.B.I.*), pubescent or hirsute, sometimes glabrous (*F.B.I.*). Lower leaves very flaccid and capillaceo-multifid, uppermost oblong prominently 3–5-nerved and serrate ·5–1·5″ long, intermediate with intermediate characters. Flowers ·4–·5″, short- to long-pedicelled in erect terminal racemes. Calyx ·15″ (·25″, *F.B.I.*), lobes with thick centre and slender points, ovate acuminate in fruit. Corolla bluish or purple, fragrant. Capsule almost globose.

Purneah, *Kurz*! Fl., Fr. Oct.–Jan.

9. **L. sessiliflora,** *Blume.*

An elegant little plant growing in masses in water or swampy places, smelling strongly of musk, with pubescent stems 4–8″ long and 4–8-nately whorled lobulate and pinnatisect leaves ·3–·5″ long, or upper leaves sometimes ·7″ and less divided, and opposite solitary axillary sessile light-purple flowers ·4–·5″ long. Capsule orbicular turgid ·17″.

In watery places. Purneah, common! Sambalpur, *Griff*! Said to be common throughout India but these are the only specimens from our area. Fl., Fr. Sept.–Nov.

A variable plant and possibly a species composed of sessile-fld. forms of

L. gratioloides and forms of *L. heterophylla* wanting the lower capillary leaves. When creeping on mud the lowest leaves only are pinnatifid with linear segments, the uppermost serrate or quite entire and 3-nerved and resembling somewhat those of *L. hirsuta*. Calyx ·2–·25″ with linear or lanceolate acuminate lobes, in fruit hemispheric membranous not striate with lobes becoming ovate long-acuminate.

10. **L. heterophylla,** *Benth.*

A larger plant than the last with glabrous stems and with numerous leaves below cut into many capillary segments, intermediate leaves 4–6 in a whorl pinnatifid, and uppermost usually opposite (sometimes also alternate) small sessile half-amplexicaul oblong crenulate. Flowers similar to the last, but more often spicate, sessile or subsessile. Calyx ·12–·15″, in fruit hemispheric membranous, not striate, and lobes ovate more shortly acuminate than in the last. Capsule broadly ellipsoid.

Purneah! Santal Parganas, *Kurz*!

14. TORENIA, *L.*

Herbs with opposite often crenate or serrate leaves and mod.-sized flowers axillary or in pseudo-umbels or racemes, pedicels ebracteolate. Calyx tubular, 3–5-winged or keeled or plicate, 2-lipped or 3–5-toothed. Corolla-tube dilated above, upper lip erect, concave, notched or 2-fid; lower larger spreading 3-lobed. Stamens 4 perfect, 2 upper included, 2 lower conniving under the upper lip and appendaged at base, anthers conniving or cohering in pairs, cells often confluent. Stigma 2-lamellate. Capsule linear or oblong, included, septicidal, valves separating from the placentiferous axis. Seeds many rugose.

Fruiting calyx ·7–·8″ long, decurrent on the pedicel . . . 1. *peduncularis.*
Fruiting calyx ·3–·5″ long, often cordate, not decurrent . . . 2. *cordifolia.*

1. **T. peduncularis,** *Benth.* Syn. T. edentula, *Benth.*, in part (*D.C. Prod.*)

A branched herb 6–12″ high with angular stems, thinly hairy at the angles and nodes with ovate or lanceolate-ovate crenate-serrate leaves ·7–1″ long (perhaps sometimes longer) and pretty blue or nearly white flowers with a dark purple-blue heart and usually violet blotches on the lateral lobes, on elongating pedicels winged by the decurrent calyx which is ·5″ long in flower and ·7–·8″ long in fruit, narrow-ellipsoid in outline.

Singbhum, in moist places! Fl., Fr. Aug.–Nov. Annual.

Leaves puberulous on the rather strong nerves, obtuse or subacute, rounded or very obtuse at the base, which is decurrent on the ·1–·3″ long petiole. Pedicels opposite, not subumbulate in my specimens (they may sometimes be so), ·5–·8″ in fruit, patent. Corolla ·8″ long. Stamens toothless.

2. **T. cordifolia,** *Roxb.*

An annual brittle branched herb of similar habit to the last, 4–12″ high, simple or 3-chotomously branched with sub-alate or sharply angled stems slightly pubescent at the angles. Leaves ovate to ovate-lanceolate ·7–2·2″ long, acute or sub-acuminate, serrate. Flowers pale blue, axillary and usually whorled or sub-umbellate at the tops of the branches, lower lip of corolla darker than the others. Calyx

·25–·3″ in flower, ·3–·5″ in fruit, wings on calyx with often a cordate base. Pedicels angled, but not winged by the decurrent calyx.

Damp shady places, common. Fl., Fr. Aug.–Dec. Chota Nagpur, all districts! Fl., Fr. Aug.–Dec.

Nervation of leaves as in the last, with about 3-5 rather strong oblique sec. n. giving out short branches to the teeth, usually puberulous beneath. Flowers sometimes very small, only ·25″ wide, at others much larger but smaller than in the last, especially the calyx. Fruiting pedicels ·5 to ·8″ spreading and deflexed.

T. Fournieri, *Linden*, is a pretty species with blue flowers with dark purple patches and broadly winged calyx often cultivated in gardens. A native of Cochin China.

15. VANDELLIA, *L.*, Mant. (1767).

(Inc. Bonnaya, *Link.**)

Usually small annual herbs growing in moist places. Leaves penni-nerved. Flowers small, axillary or racemed, ebracteolate. Sepals free or connate, sometimes sharply angled or keeled, but not winged. Corolla with erect short broad concave notched or 2-fid upper lip and broader spreading 3-lobed lower lip. Stamens 4 perfect or 2 reduced to staminodes, anterior when perfect with sharply curved filaments, often appendaged, anthers touching or cohering in pairs, cells divaricate. Stigma 2-lamellate. Capsule septicidal, short or elongate, valves separating from the placentiferous septum. Seeds rugose or granulate.

I. Calyx, at least in flower, only lobed one-third its length or less. Pedicels often sub-umbellate:—
  Flowers large. Calyx ·2–·32″. Whole plant hairy . . . 1. *stemonoides.*
  Flowers small. Calyx ·1–·16″. Glabrous or hirtellous . . 2. *crustacea.*
II. Calyx lobed three-fourths the way down or more. Pedicels axillary or racemose, never sub-umbellate:—
  A. Capsule not or scarcely longer than the calyx, ovate, oblong obtuse or orbicular:—
    Hispid all over. L. ·4–·8″. Pedicels capillary, not racemose 3. *scabra.*
    Sparsely hairy. L. ·5–2″. Flowers racemose . . . 4. *hirsuta.*
    Glabrous. L. ·5–1·2″. Flowers racemose . . . . 5. *multiflora.*
  B. Capsule much longer than the calyx, ellipsoid or linear-lanceolate, acute:—
    1. Capsule under ·25″. Sepals connate at base:—
      L. sub-orbicular, crenate-dentate. Fls. sessile and pedicelled . . . . . 6. *sessiliflora.*

* The genus *Vandellia* (*Gen. Plant.*, ed. *Schreb.*, n. 1040) has been sunk in *Lindernia* (*Gen. Plant.*, ed. *Schreb.*, n. 1031) in the *Nat. Pflanz. Fam.* and in the *Flora of Tropical Africa*. The genus *Bonnaya* differs from *Vandellia* as defined in the *Genera Plantarum* of *Benth.* and *Hooker* only by two of the stamens not bearing fertile anthers. But in view of the following considerations the separation of these two genera on this character alone appears to me artificial and untenable. In *V. molluginoides*, Hooker found in some specimens 2 filiform staminodes hooked near the top, and I have a specimen of *V. crustacea* in which the two anterior filaments appear to be without anthers. Some species of *Vandellia* can only be separated from species of *Bonnaya* by this one sexual character, *e.g.* forms of *V. angustifolia* and *V. verbenæfolia*. Finally the character of the barren stamens themselves differs and shows transitional stages. In *Bonnaya verbenæfolia* the anterior stamens in some specimens bear anthers but these are small and unfertile. In *B. veronicæfolia* there are no anthers, but the filaments are long and curved or hooked as in the case of some *Vandellia molluginoides*. In *Bonnaya brachiata* the barren stamens are short pubescent scales. I have therefore united the two genera, but transferred *Vandellia erecta* (*pyxidaria*) to *Ilysanthes* as suggested by *Sir J. D. Hooker*. But *Vandellia erecta* (= *Lindernia pyxidaria*) was the type of *Lindernia*. Hence the name "*Ilysanthus*" must disappear and "*Vandellia*" be retained. This arrangement has the incidental advantage of obviating many new combinations under *Lindernia*.

Capsule very narrow, over ·25″ long. Sepals free or connate at base:—
a. Leaves closely sharply and deeply serrate, broadly elliptic oblong. Erect rather rigid herb . . . 7. *brachiata.*
b. Leaves shallowly or obscurely serrate or entire:—
*Both pairs of stamens fertile:—
L. ovate or oblong-ovate ·3–·9″. Fls. never racemose 8. *cordifolia.*
L. linear or narrowly lanceolate. Fls. often racemose . . . . . (*angustifolia*).*
**One pair of stamens only fertile:—
L. broadly elliptic to ovate-oblong, lower shortly petioled. Calyx ·2–·3″ . . . . . 9. *veronicæfolia.*
L. linear or narrow-lanceolate, scarcely serrate. Calyx ·1–·2″ . . . . . 10. *verbenæfolia.*
L. oblong, serrate, thick. Calyx ·1–·2″ . . . 11. *oppositifolia.*
Tufted slender erect. L. linear. Calyx ·04–·07″ . 12. *tenuifolia.*

1. **V. stemonoides,** *Miq.* Syn. V. Hookeri, *Clarke.*

A rather robust plant for the genus and resembling a *Torenia*, with sharply 4-angled hairy stems, up to 11″ long, much diffusely branched. Leaves ovate-oblong, ovate or ovate-lanceolate, hairy. ·7–1·5″ long, serrate, sessile or with lower petioles up to ·4″, base decurrent on the petiole. Flowers blue-purple on spreading axillary and terminal sub-verticillate hairy pedicels. Calyx ·2–·3″ in flower or up to ·5″ in fruit, hispidly-hairy, strongly ribbed but not decurrent nor winged, sepals often distinct to base in fruit, rarely calyx 5-cleft to middle in flower. Capsule ·15–·25″. Seeds subglobose, pale-yellow, granulate-rugose.

Wet ground, rice-fields, etc. Mountains of Chota Nagpur, Singbhum! Ranchi and Palamau (Neterhat)! Parasnath, *Clarke*! Fl. Aug.–Oct. Fr. Nov.–Dec.
Easily distinguished by its hairiness. Pedicels ·3–·5″, often deflexed.

2. **V. crustacea,** *Benth.*

A glabrous, or nearly glabrous, low often diffusely branched herb 2″–12″ high with angled stems and branches, small ovate entire or serrate leaves ·25–·75″ long and axillary and terminal small purple or blue-violet flowers ·26–·35″ long with calyx ·15–·17″ long only, not divided more than one-fourth way down, sometimes splitting down one side, but not accrescent in fruit. Capsule equalling the calyx with two elliptic valves.

Very common in wet places, rice-fields, damp ravines, etc Singbhum! Manbhum, *Camp.*! Ranchi, *Clarke*! Probably in all districts. Fl., Fr. July–Dec.
Leaves sometimes crenate usually obtuse and with broad base, but sometimes suddenly contracted into the very short petiole which is ·25″ or under, sec. n. 3–4. Pedicels erect in type (see var.), slender, ·3–1·5″ long. Calyx distinctly 5-ribbed and angled, often hirtellous, teeth triangular or lanceolate. Corolla narrow, lower lip with a yellow blotch in the throat. Lower pair of stamens nearly exsert, with a geniculate knobbed filament or nearly straight. Seeds pale yellow granulate.

Var. **verticillata.** Syn. V. molluginoides, *Benth.*?

Much 3-chotomously branched with the pedicels spreading and deflexed sub-verticillate at the top of the branches.

Purneah! Ravines in Singbhum!
Except in its dwarf more rigid habit and less divided calyx this appears to be the same as *V. molluginoides, Benth.*

* For *V. angustifolia* see *V. verbenæfolia* = *Bonnaya verbenæfolia.*

3. V. scabra, *Benth.*

A little plant of similar habit to *V. crustacea*, but easily recognised by its being hispidly-hairy all over or the leaves glabrous above. The flowers have a purplish or brown-veined upper lip, a light blue or white under-lip and yellow throat and are more spreading than in *V. crustacea*, being ·25–3″ broad and long. Calyx divided nearly to the base and fruiting pedicels spreading and deflexed, not at all racemose or verticillate.

Wet ground, rice-fields, etc. Purneah, *Kew Herb.*! Ranchi, *Prain*! Singbhum! Chilka Lake, *Alcock*! Throughout India. *F.B.I.* Fl., Fr. Aug.–Jan. Also May.

Branches much spreading, often prostrate. L. small ovate or ovate-cordate, about ·4″, rarely ·8″ long, obscurely crenate, obtuse. Pedicels capillary. Calyx ·08–·1″ in flower, sometimes ·12″ in fruit, lobes lanceolate rather remote in fruit disclosing the spherical capsule, which is about ·1″ and glabrous.

4. V. hirsuta, *Benth.*

Erect succulent, sparsely clothed with spreading hairs, lower leaves petioled ovate or oblong obtuse entire or sinuate, upper sessile broader, flowers racemed, pedicels exceeding the calyx. Corolla pale yellow white, or bluish-white (*Griffith*). Sepals lanceolate, longer than the orbicular capsule.

This, which has been collected in the Sikkim Tarai as well as Bengal and the Deccan, no doubt occurs in the eastern parts at least of our area, almost certainly in Purneah.

5. V. multiflora, *G. Don.*

Similar in habit to *V. hirsuta*, but glabrous. Stems 3-chotomously branched 4–6″. Leaves sessile or narrowed into a short petiole, oblong or ovate-oblong or obovate. Flowers in numerous racemes with minute bracts and pedicels mostly under ·3″. Calyx ·08–·1″. Capsule orbicular slightly exceeding it.

Monghyr, *Ham.*! Also Maldah, on the borders of our province! Santal Parganas, *Kurz*! Fl., Fr. May (and no doubt at other times).

6. V. sessiliflora, *Benth.*

A small erect strict or 2–3-chotomously branched herb 2–6″ high with puberulous angles to the stems and branches and sub-orbicular or broadly ellipsoid rounded crenate-serrate or dentate leaves ·3–·6″. Flowers purplish not racemed, sessile and pedicelled, several together at the top of the stems, about ·25″ long. Calyx ·08–·1″, sometimes lobed only half-way down. Capsule narrowly ellipsoid, apiculate, ·23–·25″. Seeds granulate.

On damp rocks under shade. Ichadar (Ranchi), 3500 ft.! Parasnath (Hazaribagh)! Fl., Fr. July–Nov.

Leaves sometimes puberulous on midrib beneath and on the margins, sec. n. 1–2 faint. Pedicels 0–·75″ long (on same plant), deflexed in fruit or the shorter ones erect.

7. V. brachiata, *comb. nov.* Syn. Bonnaya brachiata, *Link & Otto*; Gratiola serrata, *Roxb.*

A rather rigid erect but diffusely branched herb, 3–10″ high, glabrous. Leaves sessile broadly oblong obtuse or subacute sharply closely spinulose-serrate ·5–1·5″ long, sec. n. 4, very faint or not visible. Flowers ·25″ long, pink or white, in lax terminal racemes with rigid

pedicels ·13–·25″ long. Calyx ·2″ long, lobed almost to the base with linear-subulate finely aristate sepals. Capsule linear-oblong acute ·5″ long.

Frequent in damp pastures, rice-fields, etc. Singbhum! Ranchi, *Cal. Herb.*! Gaya, *Cal. Herb.*! Manbhum, *Camp.*! Hazaribagh, *Cal. Herb.*! Probably in all districts. Fl., Fr. r.s.

Stems, branches and peduncles 4-angled. L. sometimes very minutely hirtellous beneath. Bracts linear-subulate ·17″. Seeds usually truncate both ends. Corolla white with lilac spots on the lip.

8. **V. cordifolia,** *G. Don.* Syn. Torenia diffusa, *Roxb.* (exc. syn.); Gratiola cordifolia, *Vahl.* (1805); Vandellia pedunculata, *Benth.* (1835); Torenia diffusa, *Roxb.*; Bonnaya cordifolia, *Spreng.*

A small glabrous diffusely branched herb with diffuse stems 2–12″ long sometimes procumbent and rooting. Leaves subsessile and shortly petioled, ·3–·7″ rarely ·9″ ovate or oblong-ovate obtuse or subacute, glabrous, crenate-serrate, base usually cordate. Flowers ·3–·35″ axillary not racemed, with long-spreading pedicels ·7–1″ long. Calyx ·15–·17″ glabrous. Corolla white or pale blue or with a pale violet margin, lower lip with a white or yellow spot. Capsule linear-lanceolate ·3–·4″ long, very acute, often ·1″ broad at base.

Purneah, *Cal. Herb.*, *J.D.H.*! Sambalpur, *Cal. Herb.*! In rice-fields. Probably in all districts. Fl., Fr. May–Dec.

L. often very shallowly or obscurely crenate. Fls. up to ·37″ long in some specimens. Peduncles scattered erect in flower, spreading or reflexed in fruit. Sepals subulate.

Bentham says that it is scarcely distinguishable from *Bonnaya grandiflora* (*vide V. veronicæfolia*).

9. **V. veronicæfolia,** *comb. nov.* Syn. Bonnaya veronicæfolia, *Spreng.*; Gratiola veronicæfolia, *Retz.*; Bonnaya grandiflora, *Spreng.*

A herb with very numerous prostrate often rooting square branches 4–10″ long. Leaves oblong or elliptic usually tapering somewhat at base into a very short petiole or subsessile above, distinctly but rather distantly serrate, ·5–1·25″ long. Flowers blue, pinkish or white axillary, ·4–·5″ long. Calyx ·2–·25″ in fruit. Stamens 2 upper perfect with fertile anthers, two lower longer with outwardly curved sterile filaments yellow. Fruiting pedicels divaricate ·4–·75″. Capsule linear ·5–·6″.

Wet ground. Bettiah, *Hieronymus*! Santal Parg., *Kurz*! Ranchi, *Clarke*! Singbhum! Fl., Fr. r.s. and c.s.

It has been stated that *V. cordifolia* (= *V. pedunculata*) can only be distinguished from this species by the two pairs of fertile anthers. If this be so it seems to me that they should be treated as sexual forms of the same species until physiological tests prove them to be distinct. In the present case, however, it seems to me that *V. cordifolia* is distinguishable from *V. veronicæfolia* as limited above by its more ovate leaves, shorter calyx, relatively longer pedicels and characters given below.

L. with very obscure lateral nerves, quite glabrous, acute or subacute. Flowers in my specimens not racemose (*Bonnaya grandiflora, Sprengel*), in others (*B. veronicæfolia, Spreng.*) they become racemose. The two species should perhaps be kept distinct, true *veronicæfolia* having also somewhat shorter flower ·3″ and sepals in flower ·15–·2″ as in the next species. Apart from the stamens other characters separating *V. cordifolia* and *V. veronicæfolia* appear to be as follows:—

L. mostly under ·7″ ovate cordate, shallowly crenate. Peduncles alternate. Capsule ·1″ wide at base, tapering . . . . . 8. *cordifolia.*

L. more or less elliptic or oblong or if ovate mostly over ·7″, serrate or crenate-serrate. Peduncles mostly opposite. Capsule slender uniform ·07″ wide . . . . . 9. *veronicæfolia.*

10. **V. verbenæfolia,** *comb. nov.* Syn. Bonnaya verbenæfolia, *Spreng.*; B. veronicæfolia, *F.B.I.* (in part). Incl. V. angustifolia, *Benth.*

An erect glabrous herb 5–10″ high with suberect slender branches. Leaves linear, linear-oblong or oblanceolate sparsely toothed or entire, sessile or subsessile ·5–1·7″ long. Flowers about ·35″ in terminal racemes. Pedicels divaricate in fruit ·25–·3″. Calyx ·1–·2″. Capsule linear, striate (with fine nerves), ·4–·5″.

Near Purneah, *Kurz*! Manbhum, *Kurz*! Singbhum, common in wet places! Fl., Fr. r.s.–Nov. The form with two pairs of fertile anthers occurs in Ranchi and probably with precisely the same distribution so far as can be judged from herbaria.

L. acute or obtuse, sec. n. obscure or very fine. Colour of the flowers has not been noted. Pedicels rarely attain ·8″ (in *V. augustifolia*).

Under this species I include *Vandellia augustifolia, Benth.*, and *Bonnaya verbenæfolia, Spreng.* The former appears to differ only by having both pairs of anthers perfect. My specimens of *B. verbenæfolia*, instead of showing the anterior pair of stamens reduced to mere clavate filaments as in *V. veronicæfolia*, show distinct but infertile anthers smaller than the normal ones: the filaments are correct.

11. **V. oppositifolia,** *comb. nov.* Syn. Bonnaya oppositifolia, *Spreng.*; Gratiola oppositifolia, *Roxb.*

An erect closely branched rather stout little herb, sometimes only 2″ high with angled branches. Leaves oblong, slightly serrate, sessile ·4–·6″ (attaining 1·2″, *Cooke*). Flowers ·25″, blue (*Roxb.*), axillary and upper racemed with very short pedicels mostly shorter than the calyx which is ·2–·25″ long with 1-ribbed narrow sepals. Capsule ·3″ long.

Manbhum, *Clarke*! Fl., Fr. c.s.

I do not know this plant growing.

12. **V. tenuifolia,** *comb. nov.* Syn. Bonnaya tenuifolia, *Spreng.*

A tufted erect intricately branched herb with filiform branches and sessile linear nearly entire leaves 1–1·5″ long, under ·2″ broad. Flowers very small, pale blue (*Griffith*), axillary and upper racemed, about ·12″ long. Calyx ·04–·07″. Capsule ·25–·5″ long slender.

Topchanchi (Manbhum), *Anders.*!

This also I do not know in a living state.

16. LINDERNIA, *All.* (1755).

(Including Ilysanthes, *Rafin*, 1820.)

Annual glabrous marsh herbs with leaves parallel-nerved not or usually faintly punctulate. Flowers small as in *Vandellia*, but imperfect stamens, if present, 2-lobed, one lobe glandular obtuse, the other glabrous variously shaped. Capsule and seeds as in *Vandellia*.

See remarks under *Vandellia re* inclusion of *Ilysanthes* in *Lindernia*.

Both pairs of stamens usually perfect . . . . . 1. *pyxidaria.*
Anterior pair of stamens imperfect:—
Corolla twice or two and a-half times as long as the ·08–·1″ long (in flower) calyx . . . . . 2. *parviflora.*
Corolla 3–4-times as long as the ·1–·12″-long calyx . . . . 3. *hyssopioides.*

1. **L. pyxidaria,** *All.* Syn. Vandellia erecta, *Benth.*; Vandellia pyxidaria, *Maxim.*

A small erect glabrous herb 4–8″ much branched from the base with sessile 3–5-nerved elliptic, oblong or ovate leaves often somewhat

tapering towards base, lower ·5–·75″ long. Fls. ·2–·3″ long white on very slender axillary suberect spreading or rarely deflexed pedicels ·5–·6″ long or usually twice as long as their subtending leaves. Calyx ·08–·1″ in flower, ·12–·15″ in fruit, sepals linear, rather remote in fruit. Capsule broadly ellipsoid, as long as calyx or only very slightly longer.

Frequent in swamps. Behar, *J.D.H.*!
Sometimes purplish. Leaves obscurely punctate, entire or slightly crenate, obtuse. Sepals sub-obtuse. Both pairs of anthers fully developed.
Wettstein states that *L. pyxidaria* extends from Eastern Asia to Southern Europe, that the flowers in the temperate European and Asiatic zone are mostly cleistogamous (= *L. pyxidaria*, *All.*), in the Indian region only chasmogamous (= *Vandellia erecta*, *Benth.*), and in the intermediate regions flowers of both forms occur.

2. **L. parviflora,** *comb. nov.* Syn. Ilysanthes parviflora, *Benth.*; Gratiola parviflora, *Roxb.*

This is said to differ from *I. pyxidaria* only in the reduction of the shorter stamens and in the longer acute capsule (*F.B.I.*). Erect, slender, with sometimes very numerous slender and spreading stems 4–6″. L. ovate-lanceolate ·2–·4″ or lower more elliptic, and ·7″ sessile, with 3–5 nerves from the base. Flowers white (or blue, *F.B.I.*), ·2″–·22″, on slender pedicels ·5–·7″ long. Calyx ·08–·12″ in flower, ·15″ in fruit, sepals linear-subulate, 1-nerved, acute. Capsule ·15–·2″ long, acute, striate.

Apparently more common in our province than the last. Purneah! Singbhum, frequent! Manbhum, *Clarke*! Palamau, *Gamble*! Fl., Fr. r.s.–c.s.
The anthers of the longer (not shorter) stamens in my specimens are rudimentary.

3. **L. hyssopioides,** *comb. nov.* Syn. Ilysanthes hyssopioides, *Benth.*

Habit usually much laxer than in *I. parviflora*, erect, simple, or diffusely branched. Leaves in distant pairs sessile oblong, oblong-lanceolate or sometimes narrowly lanceolate, not punctate, usually entire, 1-3-nerved. Flowers pale blue, or purple (*Wood*), ·35–·5″ long and ·3″ broad on axillary filiform pedicels ·5-1·5″ long. Calyx ·12″. Capsule ·2″ or rather less, rounded at end, minutely striate.

Sarguja, in water of small streams, elev. 1500-2000 ft., *Wood*!

17. MICROCARPÆA, *Br.*

A very small diffuse or creeping herb with opposite sessile entire narrow leaves. Flowers minute, axillary solitary sessile ebracteolate. Calyx tubular, 5-angled, 5-fid or -lobed. Corolla very short, tube broad; lobes 5, broad, spreading, 2 upper subconnate. Stamens 2, anthers confluent, 1-celled, staminodes 0. Style filiform, stigma capitate recurved. Capsule included, ovoid, 2-grooved, loculicidal; valves separating from the placentiferous septum. Seeds few, ovoid.

1. **M. muscosa,** *Br.* Syn. Ammannia dentelloides, *Kurz* (fide *Koehne*).

A very slender often tufted herb with numerous intricately branched angled creeping stems and branches 2–4″ long; angles sometimes ciliolate. Leaves linear-oblong or linear ·1–·25″ glabrous subobtuse. Flowers mostly in one axil only of each pair of leaves. Calyx ·1″, lobed about one-fourth to one-third down, lobes very acute

ciliate, mid-ribs strong, making the calyx angled. Corolla-tube shorter than the calyx. Capsule ·04–·05″.

Found with *Eriocaulon* and in damp places in general, probably quite common but not often collected. Sikkim Tarai and Northern Bengal and probably Purneah! Parasnath, *Kurz*. If this is the same, as it apparently is, with *Ammania dentelloides*, the localities of that species (*q.v.*) should be added. Fr. Oct.–Dec.

I have not seen the corolla of either. It appears to be very evanescent. The capsule in specimen examined by me had as many as 25 seeds. *Clarke* says 12-15-subhemispheric but mine are oblong. The calyx is sometimes sub-2-lipped with the upper lip 2-toothed, the lower 3-lobed.

18. GLOSSOSTIGMA, *Arn.*

Very small creeping herbs with opposite or fascicled narrow entire leaves and minute solitary axillary ebracteolate flowers. Calyx campanulate, obtusely 3–4-lobed. Corolla with short tube and 5 sub-equal lobes. Stamens 2 or 4, anther cells diverging, tips confluent. Ovary perfectly or imperfectly 2-celled, stigma dilated spathulate recurved. Capsule included loculicidal, valves separating from a columnar axis. Seeds small, ovoid.

1. G. spathulatum, *Arn.*

A minute weak flaccid tufted herb. Leaves linear-spathulate, lower tapering into a long petiole and including the petiole ·5–·6″, upper linear-spathulate ·2–·3″. Flowers ·07″ on long slender pedicels. Calyx in fruit ·08″ enclosing the globose capsule.

Behar, very abundant on the margins of tanks, *J.D.H.*! Fl. Jan.

I have not collected it. The corolla is said to be blue. Pedicels shorter than the leaves.

19. VERONICA, *L.*

Herbs or shrubs with opposite, rarely upper alternate, leaves. Flowers solitary or racemed, ebracteolate, white, blue or purple. Calyx 4–5-partite. Corolla rotate, lobes 4–5, lateral outer in bud and often broader. Stamens 2 exsert, anther-cells with confluent tips. Ovules usually many. Capsule 2-grooved, dehiscence various. Seeds various.

Leaves usually narrow. Flowers racemed . . . . . 1. *anagallis.*
L. broad. Flowers solitary axillary . . . . . 2. *agrestis.*

1. V. anagallis, *L.*

A glabrous perennial with erect or decumbent stems, 6–18″ high and sessile, or lowest petioled, oblong to linear-oblong leaves 2–5″ long, and pink or white small flowers in lax flowered slender bracteate racemes on spreading pedicels. Capsule ·12–·17″ diam.

Swamps, frequent below Maldah, *J.D.H.*! Extending into and more common in Oudh and Upper India! and therefore probably in all districts in our Northern Area. Fl., Fr. h.s.

Var. **punctata,** *J.D.H.* Syn. V. punctata, *Ham.*; var. tropicalis, *Clarke*.

A decumbent form with leaves all petioled, ovate, serrate, or the upper only linear-oblong sessile amplexicaul. Fls. white, only ·12″ diam.

Maldah, *Clarke*! Fl. Feb. This variety also extends to Benares.

The ordinary form is a common brookside and swamp herb extending as far as the British Isles.

2. **V. agrestis,** *L.*

An annual with numerous prostrate branches 4–12″ long, with petioled ovate cordate or orbicular coarsely crenate-serrate leaves ·3–·8″, and solitary axillary blue or white flowers ·17–·25″ diam. Capsule compressed, 2-lobed, ·25″ diam., hairy or ciliate, on decurved pedicels.

This is abundant in the plains of northern India and will probably be found in our Northern Area. Fl., Fr. c.s. It also occurs commonly in Britain where it is known as the "Field Speedwell."

20. SCOPARIA, *L.*

Herbs or undershrubs, with opposite or whorled, entire or toothed, gland-punctate leaves. Flowers small, sub-regular, axillary, ebracteolate. Sepals 4–5, free or nearly so, imbricate in bud. Corolla rotate 4-fid, throat densely bearded, lobes obtuse, subequal. Stamens 4, subequal; anthers subsagittate, cells parallel or diverging. Style subclavate, stigma notched or truncate. Ovules many. Capsule globose or ovoid, septicidal; valves separating from the placentiferous axis, valves with inflexed margins. Seeds many, obovoid, angled, scrobiculate.

1. **S. dulcis,** *L.*

An erect much branched fœtid herb with 3-nately whorled, glandular, serrate leaves ·5–1·5″, rhomboid or elliptic with tapering base, serrate. Flowers 3–6 from each whorl on slender ·3–·5″-long slender pedicels. Corolla delicate white, ·2″ diam. Capsule very small, ·1″, sub-globose, valves ultimately 2-fid.

Waste ground. Very common in the rains, especially in the damper districts! Fl., Fr. r.s.

Stems nearly glabrous, 4-6-angled or -lined. Upper leaves often opposite. Petiole scarcely separable from the slender leaf base. Sepals 3-nerved, slightly shorter than the capsule. Corolla divided nearly to the base. Stamens as long. Style stout.

21. CENTRANTHERA, *Br.*

Rigid scabrid herbs, with leaves opposite or upper alternate, linear or oblong. Flowers axillary or in bracteate spikes or racemes, bracteolate. Calyx compressed, spathaceous, lobes coherent or free. Corolla with long curved tube, dilated above and oblique limb with 5 broad subequal spreading lobes, 2 upper innermost in bud. Stamens didynamous, anthers meeting in pairs, cells transverse, bases mucronate or spurred, one often smaller and empty. Stigma dilated acute. Capsule ovoid or subglobose, loculicidal, valves placentiferous along the centre. Seeds very many, oblong-cuneate, testa lax, reticulate.

Erect, hispid. Corolla purple . . . . . 1. *hispida.*
Diffuse, hispidulous or usually glabrous. Corolla yellow . . . 2. *humifusa.*

2. **C. hispida,** *Br.*

An erect slender slightly branched herb 1–2 ft. high with hispid stem, narrowly linear to linear-oblong leaves ·5–1·5″ long, and purple flowers 1″ long in interrupted terminal sub-spicate racemes. Spathaceous calyx hairy, ·2–·3″ long.

Common in the rains, usually in wet grass lands. Purneah, *Kurz*! Singbhum! Manbhum, *Camp.*! Ranchi and Palamau, ascending to Neterhat! Hazaribagh, *Clarke*. Fl., Fr. Aug.-Oct.

Leaves hispid and scabrid. Flowers subsessile distant sub-opposite or alternate, only one opening at a time, corolla about ·3″ diam., slightly curved, throat darker purple than the subequal lobes. Filaments hairy, anthers with one cell empty and spurred, the other with a smaller spur. Capsules ·2″ enclosed in the ovoid oblique-mouthed toothless calyx.

2. **C. humifusa,** *Wall.*

A smaller more delicate plant than *hispida*, diffusely branched from the base, with linear to narrowly oblanceolate scabrid glabrous or hispidulous leaves ·25–·7″ long and axillary yellow subsessile flowers ·4–·5″ long. Capsule subglobose.

Grassy places. Titalyah (near Purneah), *Kurz*! Ranchi, *Prain*! Singbhum! Manbhum, *Campbell*! Parasnath, *Clarke*! Fl., Fr. Aug.-Oct.

Calyx split in front, ·17″, ovoid acute. Corolla sometimes with purple markings in the throat, tubular, dilated above.

22. SOPUBIA, *Hamilt.*

Erect herbs with the leaves narrow or finely cut, upper sometimes alternate. Flowers axillary and racemose or spicate, bracteolate, with 5-toothed or -lobed campanulate calyx and rather large corolla. Corolla-tube short, dilated above with 5 broad spreading, subequal lobes, 2 upper innermost in bud or (? in *delphinifolia*) sometimes outermost in bud. Stamens didynamous, subincluded, anthers 2 or all meeting in pairs, one cell of each perfect ovoid, the other small stipitate empty. Stigma thickened sublinguiform, obtuse. Capsule ovoid or oblong, loculicidal, with entire or 2-fid valves separating from the placentiferous axis. Seeds numerous, testa lax.

Leaves cut into filiform segments. Fls. 1-1·5″ long . . .	1. *delphinifolia.*
Leaves linear entire or sparingly cut. Fls. ·3-·5″ long . . .	2. *stricta.*
L. linear or 3-fid. Fls. as broad as long	3. *trifida.*

1. **S. delphinifolia,** *G. Don.* Dak-kadur, *S.*

A very pretty herb, 1–3 ft. high, much branched above with feathery foliage, the leaves 1–2″ long, being cut into about 5 filiform segments. Flowers axillary racemose, 1–1·5″ long, purple or rose-coloured. Calyx tube ·25″, with setaceous teeth ·4–·5″ long. Filaments with short stiff hairs. Capsule oblong, ·25–·3″.

Frequent throughout Chota Nagpur, especially on rice-bunds in the rains! Probably in all the Central and Southern Area except near the sea. Fl., Fr. r.s.

Stem grooved, smooth or hispidulous. Leaves often drying green, scabrid, segments sometimes again divided. Pedicels ·1–·2″. Bracteoles filiform. Calyx 10-nerved. Corolla narrowly tubular then ventricose, puberulous outside on the lobes.

2. **S. stricta,** *G. Don.*

An erect rigid strict or branched herb 8–20″ high with pubescent stems, narrowly linear entire, more rarely sparingly toothed or cut leaves ·5–1·5″ long, and subsessile or pedicelled purple flowers ·3–·5″ long, axillary and racemose. Calyx ·15″ pubescent with acute lanceolate teeth. Corolla purple, campanulate, closely puberulous outside. Capsule subglobose compressed at the top, ·15″–·2″ long, 4-valved.

Neterhat 3000 ft.! Sambalpur, *Griffith*! Fl. Oct.-Nov. Fr. Nov.-Dec.

3. **S. trifida,** *Ham.*, with linear or filiform mostly fascicled and 3-sect. leaves ·5–·8″ long, and yellow flowers with sub-rotate corolla, is found on Mahendragiri in Ganjam and is likely to occur on Meghasani at the end of the rainy season. The calyx is woolly within, teeth very short triangular.

23. ALECTRA, *Thunb.*

Erect, rigid, usually scabrid herbs, black when dry. Leaves opposite or the upper alternate, toothed, or reduced to scales. Flowers in terminal spikes or racemes, bracteate and bracteolate, yellow or streaked with red or brown. Calyx campanulate, 5-toothed or -fid, valvate, or open in bud. Corolla with broad tube and oblique limb, with 5 spreading lobes, the lower outer in bud. Stamens 4, didynamous; anthers touching in pairs, cells parallel, bases mucronate. Style long inflexed, stigma elongate linguiform. Capsule subglobose, loculicidal, with entire or 2-fid valves. Seeds very numerous minute, linear with very lax reticulate testa and small nucleus.

Leaves ovate to lanceolate toothed. Flowers sessile . . . . 1. *indica.*
Leaves scale-like. Flowers racemose . . . . . 2. *Thomsoni.*

1. A. indica, *Benth.*

An erect scaberulous simple or branched herb 8–15″ high, with ovate, oblong or lanceolate sharply dentate leaves ·5–1·3″ long, and yellow flowers in rather close terminal spikes, or lower axillary and very shortly pedicelled. Calyx broadly campanulate, ·25″, green, sparingly hairy, with 5 ovate very acuminate lobes. Corolla rather longer, almost ribbed. Anthers yellow.

Singbhum and Palamau, elev. 3000 ft., wet places among grass! Parasnath, various collectors! Fl., Fr. Oct.–Nov.

The plant somewhat reminds one of the English Yellow-rattle. Leaves hispidulous above, with cuneate base and 1-2 sec. n. from close to base hispidulous. Petiole short or 0. Bracteoles acicular. Capsule shorter than the calyx, subglobose, 4-lobed. Seeds linear, nucleus very small in the centre of the transparent sausage-shaped testa.

2. A. Thomsoni, *Hook f.*

An erect almost leafless herb 4–20″ high, often with several erect branches from near the base. Stems pubescent with scattered small green or purple leaves or scales mostly under ·25″ long, minutely toothed. Bracts mostly alternate. Pedicels short, ·2–·5″ long, or in some plants hardly any. Calyx strongly 10-nerved, ·2″ in flower, subglobose in fruit and ·3″ long with triangular teeth. Corolla ·25–·3″ lobed about half-way down, yellow, with 15 red nerves. Filaments hairy above, anthers purple. Stigma large oblong-clavate recurved green. Capsule 2–4-valved ovoid ·3″. Seeds with loose striate testa (in my specimens when fresh), as in *A. indica*, but more minute and elongate-cuneiform (*Hook. f.*).

In a wet gully, Singbhum, *Clarke*! *Gamble*! Rajmahal Hills, *Kurz*! Parasnath, *T.T.*, *Kurz*! My specimens were collected in the Vindhyhan Hills but in the C.P. Fl., Fr. Oct.–Jan.

The plant has the appearance of a parasite and like several others of the family may be parasitic on roots, apparently of Acanthaceous shrubs, but it is not always easy to establish the connection.

24. BUCHNERA, *L.*

Rigid annual herbs, black when dry with lower leaves opposite, broad, upper usually alternate and narrow. Flowers sessile axillary or in bracteate spikes, 2-bracteolate. Calyx tubular, 10-nerved, sometimes 5-ribbed, 5-toothed. Corolla with a slender tube and 5 flat subequal spreading lobes, 2 upper inner in bud. Stamens 4 didynamous included; anthers 1-celled, vertical, dorsifixed. Style thickened or clavate above, stigma entire or notched. Capsule oblong, loculicidal; valves separating from the placentæ but bearing parts of the septum. Seeds very numerous, obovoid or oblong, reticulated.

1. **B. hispida,** *Ham.*

An erect, strict slender hispid herb, 15–30″ high, with rather distant pairs of obovate or oblanceolate leaves 1–2·5″, sometimes smaller and linear upwards. Flowers ·4–·5″ long, small pretty blue or purple in ultimately lax elongate terminal, and sometimes also axillary, spikes one-third to one-half as long as the whole plant. Capsule oblong-ovoid, slightly shorter than the ·3″ long hairy calyx.

Frequent in grassy ground in the forests. Singbhum! Hazaribagh! Palamau, *Gamble*! Frequent at Neterhat, 3000 ft.! Fl., Fr. Oct.–Nov.

Base of stem usually with a persistent rosette of broad leaves shorter than the cauline. Cauline leaves puberulous and hispid, slightly toothed, contracted into a sessile or subsessile base. Flowering part of spike dense. Bracts linear or lanceolate, lower sometimes exceeding the flowers. Flowers curved. Calyx almost 10-ribbed, teeth short subulate. Corolla with long slender tube, limb ·2–·25′ diam. Anthers black. Capsule closely invested by the calyx.

25. STRIGA, *Lour.*

Herbs, usually scabrid and black when dry, with lower leaves opposite and upper alternate linear, sometimes reduced to scales. Flowers axillary or upper spicate, often 2-bracteolate. Calyx tubular, strongly 5–15 ribbed, 5-toothed or -fid. Corolla with slender abruptly curved tube and spreading 2-lipped limb; upper lip usually notched or 2-fid, lower larger 3-fid. Stamens didynamous, included; anthers 1-celled, vertical, dorsifixed. Style thickened above, stigma simple. Capsule loculicidal, valves carrying part of the septum but not the placentæ. Seeds very many, ovoid or oblong, reticulated.

Calyx 15-ribbed	1. *euphrasioides.*
Calyx 10-ribbed	2. *lutea.*
Calyx 5-ribbed	3. *densiflora.*

1. **S. euphrasioides,** *Benth.*

An erect herb with simple stems 4–6″ high, or branched, and attaining 2 ft., with strigose slender branches, linear leaves ·25–2″ long and terminal spikes of rather pretty pure-white flowers ·5–·7″ long. Calyx ·25–·35″ long, strongly 15-ribbed, 5-fid with one lobe usually smaller. Corolla-tube pubescent. Capsule shorter than the campanulate fruiting calyx which has often spreading lobes.

Grassy places, common. Purneah, in dry pastures, *Kurz*! Singbhum, esp. on clay soils! Manbhum, *Camp.*, *Kurz*! Ranchi! Hazaribagh, *Clarke*! Palamau, *Gamble*! Fl., Fr. July–Nov.

The commonest species and far less hispid than the next. Small states remind one of the English Eyebright (*Euphrasia*). Leaves often 1–2-toothed, with thickened margins, ·1″ broad. Calyx-lobes linear, 3-nerved, hispid, as long as the tube. Lower bracts often exceeding the calyx.

2. **S. lutea,** *Lour.*

A very slender usually strict herb 4–18″, with hispid stems and slender scabrid or hispid linear leaves ·4–·5″ long, the upper bractiform and alternate, each bearing a yellow, more rarely a red, blue or white flower ·4–·5″ long, the slender corolla twice as long as the narrow tubular 10-ribbed calyx. Capsule ·15″ oblong, dark brown.

Not very common. Wet places in grass. Purneah, *Kew Herb.*! Patna to Monghyr. *T. T.*! Ranchi! Palamau, at Neterhat, elev. 3000 ft.! Parasnath, *Kurz*! Fl., Fr. Oct.–Nov.–Dec.

Flowers very shortly pedicelled in fruit. Calyx ·25″ with 5 ribs running into the teeth and intermediate portion membranous with 5 strong nerves, teeth setaceous, about one third as long as tube. Corolla yellow in our specimens, blue in a small specimen collected by *Prain* in Ranchi.

3. **S. densiflora,** *Benth.*

Stouter than the last, 8–18″, with very scabrid and sparsely hispid stems, and leaves ·5–1·5″ long. Flowers white ·4–·5″ long. Calyx ·2–·24″, with 5 strong scabrous ribs, intermediate portions membranous but without the 5 strong nerves found in *S. lutea*.

Balugaon, Puri, *Hooper*! It also occurs in Northern Bengal and probably therefore in Purneah. My own specimens were collected in the Central Provinces. It may therefore be expected to be found anywhere in our area. Fl., Fr. Aug.–Oct.

It turns black in drying whereas *S. lutea* often remains grey or green. Linear leaves with scabrid hairs often breaking off leaving the cystolith-like base when dry. Calyx lobes lanceolate or subulate. Lower lip of corolla ·25″ wide. Lower bracts leaf-like far exceeding the flowers.

FAM. 99. OROBANCHACEÆ.

Leafless, often fleshy or scaly, root-parasites or saprophytes, with usually a simple stem and irregular flowers, solitary, spiked or racemed. Calyx spathaceous or of 4–5 free or connate sepals. Corolla hypogynous with curved tube and 2-lipped limb; upper lip arched, lower 3-fid, throat often with 2 villous folds. Stamens 4 didynamous, anthers 1–2-celled, cells more or less spurred, dehiscent by slits or pores or one imperfect. Ovary of 2 connate carpels, 1- rarely 2-celled; style long, tip curved, stigma capitate 2-lobed. Ovules usually many, anatropous on 2 pairs of free or confluent parietal placentæ which sometimes meet in the axis. Capsule 1-celled, 2-valved, or subindehiscent, few- or many-seeded. Seeds minute, testa pitted or tubercled, rarely lax and reticulated, albumen fleshy. Embryo ovoid, simple or 2-fid.

Calyx spathaceous. Cor.-lobes subequal, spreading. Anther-cells unequal or one suppressed . . . . . 1. *Æginetia.*
Calyx 4-fid or 2-partite. Corolla 2-lipped. Anther-cells equal . . 2. *Orobanche.*

1. ÆGINETIA, *L.*

Stems or scapes simple or branched, scaly or naked, bearing large solitary or few ebracteolate flowers with a spathaceous calyx split in

front nearly to the base. Corolla-tube broad, constricted above the ovary, incurved, limb obscurely 2-lipped with 5 broad spreading lobes, 2 upper connate. Stamens included, anthers with 1 cell perfect spurred in the upper stamens and gibbous (the spur may represent the empty cell), gibbous but not spurred in the lower stamens. Ovary 1-celled with large 2-lobed or multifid placentæ ovuliferous all over and filling the ovary. Stigma large peltate. Capsule sub-2-valved or indehiscent. Seeds crowded, minute, pitted.

Scapes slender, naked. Corolla purple . . . . . 1. *indica*.
Stem short stout, peduncles bracteate at base. Corolla with yellow tube and blue limb . . . . . 2. *pedunculata*.

1. **Æ. indica,** *Roxb.*

Rootstock slender with fleshy fibrous roots and usually numerous erect 1-fid. purple striate scapes which are quite naked with the exception of 1–2 bracts at the base. Flowers solitary terminal cernuous, crimson, with a spathaceous beaked calyx ·7–1″ long and a tubular curved corolla about 1·5″ long and ·5″ diam., sub-2-lipped with very short obtuse flat lobes. Capsule dehiscent by the rotting of the thin walls. Seed like brown dust.

In damp rotten vegetation under Sal and other trees, Purneah! Rajmahal Hills, *Kurz*! Manbhum, *Camp.*! Parasnath! Singbhum! Angul, *Chattarjee*! Probably in all forest districts. Fl., Fr. July–Nov.

Short erect branches from the rootstock often bear 2–3 scapes 6–12″ high. Calyx many-nerved. Placentas 4 parietal much branched.

I think this plant is a saprophyte, not a root parasite.

2. **Æ. pedunculata,** *Wall.*

A much dwarfer plant than *A. indica* but with larger flowers 2–6 on a peduncle 1–4″ high. Calyx 1·5–1·6″ yellowish. Corolla 2–2·5″, tube yellow, limb a fine purple-blue or violet, segments uniform, minutely denticulate, anthers and stigma white.

On roots of grasses, Sikkim, *J.D.H.*! Bengal, Jheels, *T.T.*, without locality! Bengal, *Griff.*, without locality! As it extends from Moradabad on one side to the Darjeeling Tarai and Dacca on the other side of our area, it is probably found within. Fl. May–July.

In some Burmah specimens the peduncles and pedicels are unusually elongated and attain 4″ with the purple-blue flowers 2·5–3″ long.

2. OROBANCHE, *L.*

Parasitic herbs with stem or scape simple or branched, with acute scales. Flowers mod.-sized in spikes or racemes, bracteoles 2 or 0. Calyx unequally 4-fid or 2-partite with the segments entire or 2-fid, or sometimes 5-merous. Corolla-tube curved, dilated above, circumsciss at the base, limb 2-lipped, upper lip erect notched, 2-fid or crenulate, lower more spreading 3-lobed. Stamens included, anther-cells equal parallel, bases usually mucronate or spurred. Ovary 1-celled, placentæ 4, stigma funnel-shaped or peltate, more or less 2-lobed with the groove median. Capsule 2-valved, valves often cohering with the style. Seeds very numerous, globose.

Flowers bracteolate. Calyx split at the back only, 4-lobed or lobes sometimes 5 . . . . . 1. *ægyptiaca* (*indica*).
Flowers ebracteolate. Calyx split into 2 2-fid segments . . . 2. *cernua*.

1. **O. ægyptiaca,** *Pers.* Syn. O. indica, *Ham.*; Turi-sim, *S.*; Sarson-banda, *H.*

A brownish parasitic herb with one to many puberulous or usually pubescent scapes 6–10″ high from a thickened base. Inflorescence usually dense with ovate acuminate pubescent bracts ·2–·3″ long, subulate filiform bracteoles ·25″ long and blue flowers ·7–1″ long, with the campanulate calyx finally split behind and regularly 4–5-lobed, the lobes finely acuminate.

Frequent in mustard and tobacco fields in most districts! Behar, *J.D.H.*, in corn and *Carthamus* fields! Gaya, *Clarke*! Hazaribagh, *Gamble*! Fl., Fr. c.s.–Feb.

Stems usually much branched and pubescent, with few ovate or lanceolate bracts below the inflorescence, which usually occupies over half their total length. Calyx often 5-merous, ·3–·35″ long, lobes as long as the tube with setaceous tips. Corolla pubescent or puberulous. Anthers minutely spurred, unequally woolly. Capsule oblong, ·2″ long.

2. **O. cernua,** *Lœfl.*

A much stouter and also dwarfer plant than *O. indica*, with stems sometimes ·5″ diam. puberulous or glabrate with conspicuous lanceolate bracts ·4–·6″ long below the inflorescence. Inflorescence dense or lower flowers sub-solitary with lanceolate acuminate pubescent bracts similar to those on the stem, bracteoles 0. Calyx split to base behind and nearly to base in front into two 2-fid segments, but sometimes one segment entire and lobes of the segments often unequal, always finely acuminate and usually coloured blue. Corolla blue, ·5–·8″ long, with very short orbicular or ovate lobes, glabrous.

On tobacco, not common. Patna, *Wall.*!

My specimens are from the Central Provinces. Fl. Sept.–Oct.

Stems or scapes simple, 6–10″, the inflorescence occupying half or more of their entire length. Calyx puberulous and with few gland-tipped hairs, ·4″ long. Anthers glabrous minutely spurred, filaments sometimes thinly hairy at base. Capsule ellipsoid, ·4″ long.

I had noted that *O. cernua* closely approached *O. nicotianæ* in the Central Provinces. *Dr. Beck* in his monograph in *Bibliotheca Bot.* unites the two and includes them both under var. *desertorum* of *O. cernua*.

FAM. 100. LENTIBULARIACEÆ.

Small herbs, sometimes climbing, inhabiting water or wet places, with leaves either simple entire radical and rosulate or capillary multifid, or nearly or quite obsolete. Flowers small to mod.-sized, irregular on 1-many-flд. scapes, bracts small or 0. Calyx inferior 2–5-lobed. Corolla 2-lipped and spurred, upper lip entire or emarginate, lower usually larger entire or 3–6-lobed. Stamens 2 attached to the base of the corolla, alternate with the lobes of the lower lip, filaments broad curved; anther cells 2, ovate, transversely confluent. Ovary superior, globose, 1-celled; style short, stigma unequally 2-lobed. Ovules very many on a free basal placenta. Fruit a 2–4-valved capsule or irregularly breaking up. Seeds many, small, exalbuminous.

1. UTRICULARIA, *L.* Bladderwort.

Herbs growing on wet rocks or banks, in which case the leaves are entire or sometimes evanescent, and the plant is then reduced to a few small roots and a scape, or growing in still or running water

with the leaves cut into capillary segments and often furnished with minute bladders. Fls. solitary or racemose on the scape, bracteate and often 2-bracteolate. Calyx 2-partite, lobes entire or nearly so, often accrescent. Seeds ellipsoid or obovoid, scrobiculate or glochidiate, rarely reticulate or comose.

Clarke states that some of the small scapose species with evanescent radical leaves on very short creeping branches may possibly sometimes grow in running water and produce elongate branched stems, longer linear leaves and reduced leaves with bladders.

The bladders of many, if not all the species which bear them, are adapted for the capture and digestion of minute aquatic animals. Bladders or recepts adapted for the capture of animalculæ are also found in the place of the leaves or on the underside of the leaves in many land forms.

I. Aquatic with elongate stems and very numerous multifid leaves. Pedicels stout in fruit. Capsule globose :—
  Large floating vesicles ·8″ long round base of scape. Fruiting sepals ·3–·4″ long. Fls. yellow . . . . . 1. *stellaris.*
  As above, but flowers white purple-streaked . . . . . var. *inflexa.*
  Large vesicles not present, but very numerous bladders. Fls. yellow. Fruiting sepals ·2–·27″ . . . . . 2. *flexuosa.*
II. Semi-aquatic with sparse filiform leaves and minute bladder-bearing branches. Scape slender 2–3-fid. :—
  Fls. yellow. Pedicels slender. Capsule globose . . . 3. *exoleta.*
III. Leaves simple at base of scape, obsolete at time of flowering. Erect or twining :—
  A. Scapes with spurred bracts :—
    Glabrous. Fls. purple subsessile. Capsule globose . . 4. *cærulea.*
  B. Bracts not spurred :—
    1. Flowers subsessile. Capsule globose :—
      Hairy. Fls. purple or blue . . . . . 5. *hirta.*
    2. Fls. pedicelled (exc. sometimes 9). Capsule ovoid :—
      a. Flowers purple or blue :—
        Bracteoles filiform. Sepals very decurrent on the pedicel in fruit, acute . . . . . 6. *reticulata.*
        Bracteoles 0. Sepals not decurrent ovate obtuse . 7. *scandens.*
      b. Flowers yellow. Very slender erect or twining :—
        Fruiting pedicels recurved, sepals ·25″, obtuse . . 8. *bifida.*
        Fruiting pedicels erect, sepals ·2″, acute . . . 9. *Wallichiana.*

1. U. stellaris, *L.f.*

A beautiful little aquatic with the stems floating for several feet, many capillary leaves and racemes of yellow-lipped flowers surrounded towards base by a whorl of large floating narrowly-ellipsoid vesicles ·7–·9″ long. Bladders on the leaf segments very minute. Racemes flexuose 2·5–4″. Fls. ·25″. Fruiting sepals ·3–·4″ long, decurrent into the short often deflexed ·1–·25 pedicel.

Purneah! Said to be found throughout India and therefore probably also in other districts. Fl., Fr. c.s.

A very distinct species. Leaves 1–2″ flaccid when removed from the water about 5-fid from the base, each segment cut into capillary lobes. The floating vesicles appear to be modified leaf rhachises and end in capillary leaf-lobes; they support the inflorescence above the water. Sepals ovate glabrous ·22″ in flower. Lower lip of corolla with a projecting transverse yellow lamella and rounded yellow labellum with brown stripes at the margin, upper lip with concave base thickened round the edge and yellow margin with brown lines, spur obtuse green with brown lines.

A variety **inflexa,** *Clarke*, with white and violet striped corolla is said to be common.

2. U. flexuosa, *Vahl.*

Somewhat similar to the last in inflorescence but without the large floating vesicles at base of peduncle. Short lateral branches of stem

(or leaves?) rigid when removed from the water ·5–1·5″ long with very numerous bladders about ·1″ long. Fls. ·3–·4″ from tip of spur. Pedicels longer clavate upwards ·3–·4″ long and deflexed in fruit and fruiting sepals shorter, ·2–·3″. Bracts very conspicuous (as they often are in *U. stellaris*), ·1–·15″ long.

Common. Singbhum! Also near Purneah, *Clarke*! and in the Central Provinces beyond Sambalpur! Probably therefore throughout the whole area. Fl., Fr. c.s.

3. **U. exoleta,** *Br.*

A small species with numerous often intricate branches bearing small bladders ·04–·05″ long and sparse filiform simple or divided leaves with capillary segments. Fls. ·2–·3″ long from tip of spur, yellow (always?, I have no note of the colour in my specimens), 1–3 only with slender pedicels on a slender peduncle 1–4″ long which nearly always has a minute barren bract near the centre. Capsule globose said to be distinctly larger than the sepals and ·2″ diam., but in my specimens (perhaps not fully developed) equalling them.

Jalpaiguri (close to but not actually within our area)! Throughout India, *Clarke*! Fl., Fr. r.s. and c.s.

Clarke says that the leaves are sometimes 2-3″, but these seem to me to be branches. The scapes appear to be sometimes 2-chotomous, the slender pedicels ·2–·4″ long. Bracts ·02–·05″, obovate. Sepals ·13″ in fruit ·1–·12″ in flower, scarcely enlarged in fruit.

4. **U. cœrulea,** *L.* Syn. U. racemosa, *Wall.*, U. filicaulis, *Wall.**

A very slender little plant consisting of single erect filiform scapes 2–8″ high without any leaves at the time of flowering. Fls. subsessile purple or blue ·25–·3″ (measuring from tip of spur). Bracts scattered along the scape and under the flowers ·05–·08″ long with a slender spur often as long as the narrow acuminate blade. Fruiting sepals ovate ·1–·12″ long.

Common in rice-fields. Singbhum! Manbhum, *Camp.*! Hazaribagh, *Clarke*! Neterhat (Palamau), 2500 ft.! Fl., Fr. Sept.–Dec.

Easily distinguished by the bracts. Whole plant glabrous. In the type flowers numerous and often clustered, in var. *filicaulis*, *Clarke*, which is the commoner in our area, the flowers are sparse and distant.

Upper lip of corolla very narrow, lower 4-lobed, spur rather stout and exceeding the lips. Capsule ovate subglobose compressed.

5. **U. hirta,** *Klein.*

Very slender, erect, 3–8″, pubescent or minutely villous, leafless at time of flowering. Fls. subsessile blue with dark veins, white or yellowish at throat, solitary and in few-fld. spikes, ·2–·3″ long. Bracts not spurred. Fruiting sepals orbicular ·1″. Capsule as long globose.

Giridih, Hazaribagh, *Clarke*! Manbhum, *Camp.*! Fl., Fr. Oct.–Nov.

6. **U. reticulata,** *Smith.*

A comparatively stout glabrous species twining or in young states and in var. *uliginosa* slender erect and only 3–8″, leafless when in

* *Dr. Stapf* states that the confusion with regard to these names starts with *Linnæus* himself, but there is no doubt that this is the original *U. cœrulea* described in the *Flora Zeylanica*. *U. cœrulea* of the *F.B.I.* is quite different, though the *name* is unfortunately much more applicable to it. It has beautiful sky-blue flowers and may possibly be found in the hills of our area as it occurs in those of the Central Provinces.

flower. Flowers on ·25–·3″ long pedicels, very pretty, blue and sometimes ·8″ long, at other times much smaller, with narrowly conic nearly straight spur. Sepals in fruit ·25–·3″ elliptic acute veined decurrent on the pedicel.

Orissa, *Cal. Herb.*! Singbhum! Fl., Fr. Aug.–Sept.

Lower lip of corolla broadly ovate, scarcely emarginate. Seeds obovoid scrobiculate (*Clarke*). Bracteoles 2, filiform.

7. **U. scandens,** *Benj.*

A very small glabrous twiner with small pale lilac or blue flowers ·15″ scattered along the upper three-fourths of the slender filiform stem. Pedicels ·06–·1″ deflexed in fruit. Calyx lobes ovate obtuse ·1–·12″ in fruit. Seeds yellow obovoid, very faintly striate (laxly scrobiculate, *Clarke*).

N. Bengal, *Kurz*! Rice-fields, Singbhum! Fl., Fr. Sept.–Oct.

8. **U. bifida,** *L.*

Slender glabrous 3–7″ erect, " or will twine round a grass," *Clarke*. Flowers yellow or yellow with brown-yellow spur. Fruiting sepals ·2–·25″ usually rounded at the tip, very decurrent on the cernuous ·1–·2″ long pedicel. Bract oblong, bracteoles filiform.

Singbhum (rather doubtful; the sepals are cuspidate)! Sambalpur, *Griff.*! Hazaribagh, *Clarke*! Fl., Fr. Sept.–Oct.

Before flowering it has, like several other species of the section, numerous erect linear leaves ·6–·7″ long on the filiform creeping stems.

9. **U. Wallichiana,** *Wight.*

Very slender and twining or reduced to a short erect filiform stem 1–2″ high with only 1–few flowers. Flowers ·2–·4″ clear-yellow with nearly straight tapering pointed spur about as long as or longer than the lower lip. Pedicels 0–·25″ erect or suberect in fruit and fruiting sepals ·2″ ovate, very acute or cuspidate, somewhat decurrent on pedicel.

Manbhum, *Campbell*! Wet ground alongside streams and on their banks, Neterhat, 3000 ft.!

Usually growing with minute sedges and often slightly twining on them. Bracts ovate acute, bracteoles filiform. Spur usually lying parallel to lower sepal and exceeding it and divaricate in a straight line with the upper obovate lip, lower lip broad, emarginate. Capsule lenticular.

FAM. 101. GESNERACEÆ.

Undershrubs or more usually herbs, sometimes reduced to a single leaf and inflorescence. Leaves opposite or alternate, simple, exstipulate. Flowers often showy and large but sometimes much reduced, usually racemose, rarely cymose or clustered or solitary, bracteate and with usually small bracteoles, 2-sexual, more or less zygomorphic. Calyx 5-merous, sepals valvate or open in bud. Corolla with long or short tube and usually 5 imbricate lobes. Stamens on the tube, usually didynamous, often only 2 fertile, rarely 5 fertile, anthers 2-celled or cells confluent. Disc annular or unilateral or 0. Ovary superior or

sometimes half-inferior (in American genera), 1-celled or more rarely 2-celled; style linear, stigma small capitate or 2-lobed; placentæ parietal 2-fid. Ovules very many, anatropous. Fruit capsular or baccate, dehiscent or indehiscent. Seeds very many, minute, fusiform or ovoid. Albumen 0 or scanty, embryo straight.

There is no hard and fast line between this family and the *Scrophulariaceæ*; the habit is often very characteristic in the large leaves and short or obsolete stem, as also is the frequently 1-celled ovary and 2-fid placentas. Our species all belong to the tribe Didymocarpeæ in which the fruit is an elongate loculicidally 2-valved or finally 4-valved capsule, placentæ deeply intruded and seeds without hairs.

The well-known garden and greenhouse plants *Achimenes*, *Gloxinia*, *Gesnera* and *Streptocarpus* are typical of the family.

I. Capsule ellipsoid membranous, placentæ 2-fid bearing ovules on all sides:—
Caulescent with unequal-sided leaves. St. 2 perfect . . 1. *Rhynchoglossum.*
II. Capsule linear. Placentæ not ovuliferous on their inner sides:—
Stamens 2 perfect . . . . . 2. *Didymocarpus.*
Stamens 4 perfect . . . . . 3. *Didissandra.*

1. RHYNCHOGLOSSUM, *Blume.*

Herbs with usually a leafy stem, rarely leaf only one in starved forms. Leaves alternate, unequal-sided, pinnate-nerved. Flowers in ebracteate racemes with minute bracteoles. Calyx campanulate, somewhat zygomorphous. Corolla with tube contracted at the mouth, 2-lipped, upper lip short 2-fid, lower longer 3-lobed. Stamens 2 perfect, included; anthers connivent 2-celled, slits ultimately confluent at the apex. Ovary ovoid; placentæ deeply intruded and 2-fid, the lamellæ bearing ovules on all sides. Capsule included ellipsoid, membranous, loculicidally 2-valved. Seeds narrowly ellipsoid with minutely reticulated testa.

1. **R. obliquum,** *Blume.* Var. parviflorum, *Clarke.*

A rather succulent herb varying from 3–4″ high with a single leaf to 18″ high with many leaves in the same locality. Leaves membranous 1–4·5″ elliptic or ovate acuminate, with a semi-cordate base and many rather strong oblique nerves, nearly glabrous, petiole variable. Flowers blue secund in elongate many-fld. racemes, rhachis minutely densely pubescent up to 6″ long in well-grown plants, bracteoles small linear.

Wet shady banks. Parasnath, Hazaribagh, chiefly above 4000 ft.! Fl., Fr. Oct.–Nov.

Pedicels ·05–·15″ long, curved. Calyx with 2-lobed upper lip and more deeply 3-lobed lower lip. Corolla twice as long, ·3″, upper lip blue somewhat reflexed 2-lobed, lower sub-entire, throat yellow closed. Capsule membranous easily dehiscent almost enclosed by the angular nearly glabrous calyx.

2. DIDYMOCARPUS, *Wall.*

Herbs, sometimes stemless, with opposite, alternate, 3–4-nate or crowded or sometimes solitary leaves. Flowers large or very small (in our species), cymose, sub-umbelled or sub-racemose in pairs, on axillary peduncles or pedicels few short and fascicled. Calyx small 5-fid or -partite. Corolla with cylindric or ovoid tube with oblique or sub-symmetric mouth, limb with 5 rounded lobes often 2-lipped.

Stamens 2 perfect and 2–3 rudimentary, anthers cohering in pairs, cells ovate soon confluent. Ovary sometimes stalked, narrow, stigma rarely 2-lobed, often peltate or unilateral, placentæ deeply inflexed then recurved and bearing ovules on their outer faces only. Capsule linear, loculicidally 2-valved or subfollicular, ultimately often 4-valved bearing the placentæ on the valves which are revolute and conceal the seeds. Seeds ellipsoid, minutely reticulate.

1. **D. pygmæa,** *Clarke.*

A curious little plant usually with a short straight or curved succulent weak stem 1–2·5″ high and a single broadly oblong or ovate membranous sessile leaf 1·5–3″ long. Flowers inconspicuous, 1–4, clustered, subsessile or with pedicels up to ·3″. Calyx-segments hairy ·1″ elongating in fruit to ·25″ linear. Capsule ·4–·5″ linear acuminate.

On damp banks and rocks in the hills of Chota Nagpur, elev. 2000 ft. and over. Ranchi, several times collected; Jonha, *Wood*! Ormanjee, *Clarke*! and by me at nearly the same place in the Damuda Ghats! I have also collected it at Pachmari in the Central Provinces. Fl., Fr. Aug.–Oct.

Nearly the whole plant more or less covered with hyaline hairs and the leaves with a glistening surface when fresh. There is sometimes a short stem above the single leaf bearing 1–2 very small leaves or sometimes there are two sub-opposite or alternate principal but unequal leaves, or a small subsidiary leaf below the principal. Bulbils, sometimes borne instead of flowers, usually 3-gonous. Principal leaf with shallowly cordate base, sometimes crenate towards apex, sec. n. 6–9 of which several are near the base. Flowers appear to me to be cleistogamous with a colourless corolla ·1″ long or sométimes ·25″, tubular.

3. DIDISSANDRA, *Clarke.*

Characters of *Didymocarpus* but fertile anthers 4.

1. **D. lanuginosa,** *Clarke,* var. **minuta,** *Haines.*

A very small herb without appreciable stem but several elliptic or ovate or orbicular-ovate leaves ·75–1·5″ appressed to the substratum and a thinly hairy scape 2″ high with 2–3 *lobelia*-like pale purple-white flowers ·4″ long. Capsule linear ·7–·9 inches somewhat 4-grooved, tapering to a short beak, 2-valved.

On damp rocks (laterite) under shade at 3000 ft., Neterhat! Fl. June-July. Fr. c.s. Very rare.

L. rounded at tip, base narrowed into a short broad petiole about ·2″ long, beneath pale and with long matted hairs on the 3–4 strong sec. n., above pilose with tubercled-based hairs and nerves impressed; sec. n. forked, their branches ending in the crenulate margin. Calyx-lobes linear oblong, ·05–·07″. Cor.-tube somewhat inflated compressed with two lines on lower face hirsute, less hairy between the lines, upper lip with 2 short rounded lobes, lower much larger with 3 oblong obtuse lobes. Stamens included, 2 lower ascending distinct, two upper inclined forward with anthers conniving under the stigma. Pedicels clavate beneath the fruit. Seeds minute brown, ellipsoid, smooth. Cotyledons (on germination) minute orbicular.

It differs from the type, which is a Himalayan plant, in the short simple scapes and very small leaves and flowers.

FAM. 102. BIGNONIACEÆ.

Trees or shrubs, often climbing (in exotic species), with opposite, rarely whorled or spiral, 1–3-pinnate, rarely simple leaves. Stipules absent (in indigenous species). Flowers large or moderate-sized,

2-sexual, zygomorphic in racemes or panicles with inconspicuous bracts (sometimes solitary or clustered on the old wood in exotic genera). Calyx spathaceous or 2–5-lobed. Corolla usually tubular below, then ventricose, subregular or 2-lipped, lobes usually subequal and imbricate, rarely valvate, in bud. Stamens 4 didynamous, often with the 5th present as a staminode, rarely (*Oroxylum*) 5 perfect, usually inserted anteriorly in the corolla; anthers 2-celled, usually included, cells parallel or divaricate. Disc usually conspicuous, rarely 0. Ovary 2-celled (or, in Crescentieæ, which are all exotic, 1-celled); style long, stigma of 1–2 elliptic or linguiform lobes. Ovules many, 1–more-seriate in each cell, anatropous. Fruit elongate and capsular and 2-valved (in indigenous genera), the valves separating from the often swollen axis, rarely (some exotic genera) indehiscent. Seeds flat or trigonous, prominently winged, exalbuminous; cotyledons flat or folded.

Germination (in the few cases observed) epigeal with the expanded cotyledons deeply 2-lobed and petioled.

I. Ovary 2-locular. Fruit capsular, 2-valved (genera 1–9):—
- A. Capsule septifragally dehiscent, the valves parallel to the compressed septum (*Bignonieæ*):—
  - 1. Trees with 2–3-pinnate leaves:—
    - Small tree. Fls. dark red, corolla very broad. St. 5 . 1. *Oroxylum.*
    - Tall tree. Flowers white with long slender tube . 2. *Millingtonia.*
  - 2. Exotic climbers with showy flowers, leaves 3-foliolate or 2-foliolate and the terminal converted into a tendril . . . . . 3. *Bignonia.*
- B. Capsule loculicidally dehiscent, the valves transverse to the septum, or septum (with placentæ) terete corky:—
  - 1. Exotic climbers or with branches rooting at the nodes, leaves pinnate, never ending in a tendril . . . 4. *Tecoma.*
  - 2. Trees or erect shrubs:—
    - *a.* Leaves simple . . . . . 4. *Tecoma* (*Tecomella*).
    - *b.* Leaves compound:—
      - i. Staminodes short or 0:—
        - * Calyx not spathaceous:—
          - ! Leaves 1-pinnate (rarely in *Tecoma* sub-2-pinnate):—
            - Exotics. Calyx equally 5-toothed. Septum compressed . . . . . 4. *Tecoma* (*Stenolobium*).
            - Indigenous. Calyx 3-5-lobed. Septum terete, seeds grooved between the wings . . 5. *Stereospermum.*
          - !! Leaves 2-3-pinnate. Septum terete. Seeds flat, not grooved between the wings . . 6. *Radermachera.*
        - ** Calyx spathaceous:—
          - Corolla with elongate tubular base white . . 7. *Dolichandrone.*
          - Corolla broadly campanulate, red, tubular base very short . . . . . 8. *Spathodea.*
      - ii. Staminode very long, clavate at tip:—
        - Exotic tree with pretty 2-pinnate leaves and blue flowers . . . . . 9. *Jacaranda.*

II. Ovary 1-locular or if 2-locular then flowers clustered on the old wood. Exotics (*Crescentieæ*):—
- A. Calyx spathaceous. Ovary 2-locular. Leaves 3-foliolate 10. *Parmentiera.*
- B. Calyx not spathaceous. Ovary 1-locular:—
  - Leaves pinnate. Racemes on very long pendulous peduncles . . . . . 11. *Kigelia.*
  - Leaves simple, alternate. Flowers clustered or solitary . 12. *Crescentia* (p. 660).

1. OROXYLUM, *Vent.*

Small trees with very large pinnately compound leaves and entire leaflets. Flowers large subregular in long terminal racemes. Calyx broad campanulate, coriaceous, scarcely toothed. Corolla campanulate with a short tubular base and subequal rounded lobes imbricate in bud. Stamens 5 somewhat exserted, with subparallel anther-cells, Disc prominent. Ovary compressed. Ovules numerous many-seriate in each cell. Capsule very large, flattened parallel to the septum, septicidally 2-valved. Seeds broadly ellipsoid with broad hyaline wing.

1. **O. indicum,** *Vent.* Sauna, *Th.*; Sona, *H.*; Som Sonpatta, *Kharw.*; Rengebanam, *K.*; Bana hatak', *S.*; Dantkura, *Mal Pah.*; Phapni, *Or.*; Jai mangal, *Gondi.*

A small tree rarely over 25 ft. with but few branches and terminal clusters of very large ternately 2-pinnate leaves 2–4 ft. long and broad. Flowers large fleshy purple, but not showy, in terminal stout racemes. The tree is easily recognised when leafless by the large leaf-scars and immense flat pods 1–3 ft. long with woody valves and flat winged seeds 2–3″ diam.

In the sub-montane grass lands of the Northern Area and throughout the province along streams and ravines and on the cool sides of the hills in the forest districts. Fl. July–Aug. Fr. Dec.–March. Deciduous Dec.–June.

Bark soft with pale yellowish-green blaze. Leaflets about 5″ by 3″ acuminate. Corolla 2–3″ long and broad. Fifth stamen rather shorter than the others.

Seeds purgative, *Wood.* They are however sometimes eaten. *Mr. Innes* says that in times of famine they are parched and ground into flower.* The bark and fruit are sometimes used in tanning and dyeing according to *Gamble.* Weight about 30 lbs. per c. ft. No use is known for the wood. The growth of a tree sown by me at Chaibassa was 25 ft. in height and 20″ girth in 16 years, but the locality was unfavourable to it.

2. MILLINGTONIA, *L.f.*

Tree with opposite 2–3-pinnate leaves and relatively small leaflets. Flowers white in terminal panicles. Calyx small campanulate with five obscure teeth. Corolla with long slender tube, sub-2-lipped with 5 subequal subvalvate lobes. Stamens 4 perfect didynamous, anthers 1-celled with a second small hooked barren cell. Capsule linear, compressed parallel to the septum, septicidally 2-valved. Seeds thinly discoid with broad hyaline wing.

1. **M. hortensis,** *L.* Akas-nim, *H.*; Bakeni, Reali, *Or.*; Indian Cork Tree.

A tall handsome tree with narrowly pyramidal crown and 2–3 pinnate leaves 1–3 ft. long with ovate or ovate-lanceolate acuminate sinuate or crenate leaflets 1–3″ long. Panicles usually inclined with very numerous pendulous white fragrant flowers 2–3″ long and 1″ diam. Capsule 12″ by ·75″, acute both ends.

Very commonly planted in gardens and avenues and often self-sown. Fl. Oct.–Dec. Native of Burma.

It throws up very numerous root suckers. The great height of the tree renders it liable to be thrown by the wind.

* Appendix to *Indian Forester*, February, 1903.

3. BIGNONIA, *L.*

(Limited according to *Bentham* and *Hooker*.)

Usually widely scandent shrubs with opposite 3-foliolate leaves or the terminal leaflet converged into a tendril (rarely leaves ternately or sub-pinnately decompound); leaflets nearly always entire. Stipules or a stipuliform leaflet rarely present (*Panterpa*, Miers). Flowers large or mod.-sized, showy, in terminal or axillary cymes or panicles. Calyx campanulate or tubular, mouth straight or oblique, truncate or shortly 5-toothed or -lobed or sinuate, rarely shortly unequally split or the ribs produced into subulate teeth. Corolla-tube often elongate, usually widened above, straight or incurved with a more or less 2-lipped limb; upper lip 2-lobed, lower 3-lobed or -partite, lobes broad spreading. Stamens didynamous, inserted near base of corolla-tube, included or rarely shortly exsert, anthers glabrous, cells finally divaricate, rarely (*Pyrostegia*, Presl.) mature parallel. Disc pulvinate, annular or sub-cupular or 0 (*Cydista*, Miers). Ovary 2-celled, ovules 1- or densely sub-2–3-seriate. Capsule compressed parallel to the septum, septifragally dehiscent, often leaving a filiform portion of the wall detached or attached to the septum. Seeds 1- or scarcely 2-seriate on the margins of the septum, flattened with broad wing (sometimes wanting at the base and apex).

A large American genus which is now usually yet further split up into several genera such as are indicated in brackets above and in the following Key. I have collected no specimens, and the following is a very incomplete account of some of the most commonly cultivated in gardens in the provinces:—

I. Tendrils short 3-clawed (*Bignonia*) . . . . . 1. *unguis-cati.*
II. Tendrils slender, not clawed (sometimes 0 in lower 3-foliolate leaves):—
  A. Disc present, conspicuous:—
    1. Corolla-lobes valvate in bud. Tendrils 3-fid (*Pyrostegia*):—
      Corolla tubular-funnel-shaped, lobes very short . . 2. *ignea* (*venusta*).
    2. Corolla-lobes imbricate:—
      a. Tendrils simple.
        Capsule slender linear (*Arrabidea*) . . . . None described.
        Capsule broad, rough or echinate (*Clytostoma*):—
        Flowers rose with darker stripes . . . . 3. *callistegioides.*
        Flowers purple . . . . . 4. *noterophilum.*
      b. Tendrils repeatedly 3-fid (*Doxantha*) . . . None described.
  B. Disc 0. Tendrils simple. Ovary scaly (*Cydista*)*:—
    Flowers rose or purple . . . . . 5. *æquinoctialis.*
    Flowers flesh-coloured or pale lilac, darker-veined . . 6. *incarnata.*
    Flowers primrose-yellow . . . . . 7. *Chamberlaynii.*
    Flowers pale mauve to crimson, throat primrose . . 8. *magnifica.*

1. B. unguis-cati, *L.* Syn. B. gracilis, *Lodd.*

A shrub extensively climbing by means of its 3-fid claw-like tendrils, with a pair of rich green shining broadly oval acuminate leaflets about 2″ long and a profusion of bright-yellow flowers about 2″ across or more.

Native of Central America to Southern Brazil and the Argentine. Flowers two or three times in the year.

* The correct sub-genus of *magnifica* is not known to me as material is not available to determine it.

2. **B. venusta,** *Ker-Gawl.* Syn. Pyrostegia ignea, *Presl.* (the correct but less familiar name).

A very large shrub with pinnately 2-foliolate leaves and a terminal 3-fid slender tendril. Lflts. sometimes 3 on the lower leaves, ovate, about 3″ long. Flowers very numerous and showy, vermilion or orange, about 3″ long with the corolla-tube 2·25″, in axillary crowded drooping corymbose cymes.

Very common in gardens. Fl. Jan.–Feb. Better known under its horticultural name *B. venusta*, under which it was originally figured in *Botanical Register*.

3. **B. callistegioides,** *Chamb.* Syn. Bignonia speciosa, *Grah.*; Clytostoma callistegioides, *Bur.* (the correct name).

Branchlets, young leaves and petioles puberulous. Tendrils simple. Lflts. obovate-oblong acuminate, 2·5–3″ long, shining, base subcordate. Flowers lilac or rosy red with darker veins, about two together only on the peduncles; the pedicels longer than the peduncle. Calyx obliquely campanulate with acute teeth. Corolla pubescent, lobes orbicular-obovate half as long as the tube which is about 2″. Pod short oblong densely echinate.

Native of Southern Brazil and Argentine.

4. **B. noterophila,** *DC.* Syn. Clytostoma noterophila, *Kew Herb.* (correct name); Bignonia purpurea (usual horticultural name in Calcutta).

Quite glabrous. Tendrils simple. Leaflets oval acuminate, base acute, both sides reticulate-venose. Flowers rosy-purple 2″ long on axillary 2-flowered peduncles with several ovate acute bracts. Calyx campanulate, minutely 5-toothed. Corolla glabrous outside, lobes orbicular.

Native of Brazil.

5. **B. æquinoctialis,** *L.* Syn. Cydista æquinoctialis, *Miers*; C. spectabilis, *Miers*?

An extensively climbing shrub with the slender green branches terete but subcompressed at the ends. Tendrils simple sometimes very short. Leaflets ovate- or elliptic-lanceolate rich green, shining, obtusely-acuminate, reticulately nerved. Flowers purplish or rose with deeper-coloured veins never at all yellow (according to *De Candolle*) in copious axillary and terminal panicles. Calyx cupular, truncate. Corolla glabrous. Capsule long linear. Seeds almost spherical, winged.

Native of Guiana.
Corolla tubular-campanulate with two plaits on the lower side. Disc 0.

6. **B. incarnata,** *Aubl.* Syn. Cydista incarnata, *Miers.* Apparently reduced to Cydista æquinoctialis in Kew Herb. Includes also B. spectabilis, *Vahl.*

A large climber with 3-foliolate leaves of which the terminal leaflet is usually transformed into a simple tendril. Lflts. coriaceous, shining, lanceolate, 3–4″ long. Flowers pale-lilac or flesh-coloured,

sometimes veined with a deeper colour, 2–2·5″ long and 1–2″ wide, tube white inside.

Frequent in gardens. Native of Guiana. Fl. h.s.
Leaflets attain 6–7″ in lower part of stem, ovate-lanceolate and often ternate. Calyx sub-truncate. Disc inconspicuous. *De Candolle* says that it differs from *B. æquinoctialis* by the 4-gonous branches.

7. **B. Chamberlaynii,** *Sims.* Treated as synonymous with B. æquinoctialis at the Agri-Horticultural Society's Gardens, Calcutta (probably following *Firminger*).

A glabrous scandent shrub with terete branches. Differs from the ordinary *æquinoctialis* by the primrose-coloured flowers and more distinctly 5-toothed calyx.

Native of Brazil.
Firminger says—"From the axils of the leaves are produced primrose-coloured thimble-formed flowers, with the tube 2″ long, produced in great profusion nearly at all times."

8. **B. magnifica,** *Bull* in *Gard. Chronicle.*

Bull gives merely a figure, uncoloured, and a short description from which it is not possible to determine the genus, and I find no specimens in the Kew Herb. *Mr. Sprague* tells me that this is not synonymous with *Cydista magnifica, Miers.* It is a very handsome plant with large panicles of flowers up to 3·5″ across, delicate mauve changing to rich crimson with throat of a light primrose.

Native of Columbia, U.S.

4. TECOMA, *Juss.*

Trees or shrubs often scandent or rooting at the nodes but without tendrils. Leaves opposite simple or digitately or pinnately compound, leaflets often toothed. Flowers usually showy, most often yellow, red or orange, racemed or panicled at the ends of the branches or leafy shoots. Calyx tubular-campanulate, sub-equally 5-toothed. Corolla with long straight or incurved tube, slightly widened upwards or much dilated at the throat; limbs sub-2-lipped with 5 broad sub-equal spreading or sub-erect lobes. Stamens didynamous, included or exsert, anthers with cells at first often parallel finally divergent or divaricate. Disc annular. Ovules on each placenta 1–many-seriate. Capsule linear or narrowly ellipsoid, usually acute both ends, more or less compressed parallel to the septum but loculicidally dehiscent with the concave or cymbiform valves transverse to the septum. Seeds at margin of the septum, 1–many seriate, wing at both ends usually broad and membranous.

Tecoma, like *Bignonia*, is now usually divided into several genera (indicated in brackets in the following Key). Only one species, of the sub-genus *Tecomella*, is indigenous.

I. Erect trees or shrubs:—
  A. Leaves simple or palmately divided:—
    1. Wing of seed thick, only membranous at margin. Leaves simple (*Tecomella*, Seem.) . . . . . 1. *undulata.*
    2. Wing of seed membranous. Leaves 3-5-nately divided (*Tecoma* proper). All American . . . . . None described.
  B. Leaves pinnate (rarely reduced to a single leaflet). Anther cells much expanded, often hairy (*Stenolobium*, Don) . . 2. *stans.*

II. Climbers, without tendrils :—
A. Stamens exserted (*Tecomaria*, Fenzl.) . . . . . 3. *capensis.*
B. Stamens included :—
1. Flowers in clusters. Fruit elongate (*Campsis*, Lour.) :—
Calyx shortly lobed, glandular . . . . . 4. *radicans.*
Calyx deeply lobed without glands . . . . . 5. *grandiflora.*
2. Flowers in panicles. Capsule oblong (*Pandorea*, Endl.) :—
Panicles large loose, corolla-lobes more than half as long as tube . . . . . 6. *jasminoides.*
Panicles dense, short, lobes not half so long as tube . . 7. *australis.*

1. **T. undulata,** *G. Don.* Syn. Tecomella undulata, *Seem.*

A shrub or small tree with narrowly oblong entire undulate leaves about 6″ long and orange-red flowers in corymbs mostly terminating short lateral branches. Capsule 8″ by ·3″, slightly curved. Seeds 1 by ·3″ including the wing, which is very narrow at the apex and absent at base.

Palamau, *Hendley* ! Collected by *Dr. J. P. Hendley* on waste land "with every appearance of being wild." Fl. April. It is indigenous also in the dry country of western India.

Young shoots grey puberulous with stellate hairs. Leaves obtuse. Petiole ·7″ long. Pedicels ·25–·5″. Calyx ·3″, lobes short broad obtuse. Corolla 1·5″ tubular-ventricose with 5 rounded lobes. Stamens scarcely exsert, glabrous, anther-cells pendulous, narrowly oblong.

2. **T. stans,** *L.* Syn. Stenolobium stans, *D. Don.*

A very pretty small tree or large shrub with opposite decussate pinnate or sub-2-pinnate leaves and 7–11 lanceolate serrate or deeply gashed leaflets 3–4″ long. Flowers golden yellow in terminal corymbs or clusters. Corolla tubular-ventricose about 1·5″. Capsules 6–9″ linear, compressed.

Very common in gardens and easily raised from seed. Native of the West Indies. Fl. c.s.

Var. **apiifolia** has even more graceful foliage with the leaflets deeply incised or sub-pinnatifid or forked.

As common as the last.

3. **T. capensis,** *Lindl.* Syn. Tecomaria capensis, *Spach.*

A glabrous climber with pinnate about 9-foliolate glabrous leaves with ovate serrate leaflets. Flowers orange red about 2″ long in dense peduncled racemes. Corolla tubular incurved. Stamens exsert, anther-cells divaricate.

In gardens and plant-houses. Native of the Cape.

4. **T. radicans,** *Juss.* Syn. Campsis radicans, *Seem.*

A spreading shrub emitting roots from its branches where they touch the soil or sub-stratum, with pinnate leaves and 9–11 ovate-acuminate dentate-serrate leaflets puberulous on the nerves beneath. Flowers in great profusion orange-scarlet tubular 1·25″ long in drooping corymbs.

Flowers most of the year. Native of tropical America.

5. **T. grandiflora,** *Delaun.* Syn. Campsis grandiflora, *K. Sch.*

A handsome climbing shrub, also with numerous rooting branches, "graceful spray-like foliage of bipinnate leaves; seven leaflets roundish, saw-edged, about ·75″ long" (*Firminger*). Flowers orange-coloured, in large drooping clusters, corolla shorter and broader than in *T. radicans* with the tube scarcely longer than the calyx.

Fls. h.s., deciduous in c.s. Native of Japan.

Firminger seems wrong in calling the leaves 2-pinnate; they are odd-pinnate with 7–11 ovate acuminate dentate-serrate leaflets.

6. **T. jasminoides,** *Lindl.* Syn. Pandorea jasminoides, *K. Schuman.*

A scandent shrub with dark green pinnate leaves and 5-7 ovate shining entire leaflets. Flowers large rosy-white with dark purple centre, corymbose. Corolla tubular-campanulate with broad mouth.

A beautiful plant almost constantly in blossom. Native of New Holland.

Cooke says that it has pale bluish flowers!

7. **T. australis,** *R. Br.* Syn. Pandorea australis, *Spach.*

A large woody climber with pinnate glabrous leaves with 7-9 elliptic sub-entire leaflets and axillary panicles of heavily scented tawny yellow flowers more or less spotted with purple. Capsule oblong.

Native of Australia.

5. STEREOSPERMUM, *Cham.*

Trees with odd-pinnate leaves, opposite or clustered (and apparently spiral) at the ends of the branches, leaflets entire or toothed. Flowers mod.-sized in terminal ample lax panicles with opposite decussate branches. Calyx campanulate 2–5-lobed or -toothed. Corolla curved tubular-campanulate 2-lipped with very short narrowly-tubular base, lobes sub-equal, imbricate in bud; often crisped or toothed. Disc sub-cupular. Stamens included didynamous, with diverging or divaricate anther-cells. Ovary linear-oblong with many ovules 2-seriate in each cell. Capsule terete or 4-angled elongate, often spiral, with a corky cylindrical septum in the excavations of which lie the nuclei of the seeds which have somewhat thick membranous wings separated by a groove. Embryo folded.

A. Corolla woolly at base of stamens:—
Leaves and panicles glabrous or nearly so. Lflts. elliptic, suddenly caudate. Capsule slender 4-angled or -winged . 1. *tetragonum.*
B. Corolla not woolly at base of filaments, anterior surface within villous:—
Lflts. narrowly elliptic to oblanceolate-oblong. Panicle pubescent not very viscous. Pod ·3″ diam. . . . . 2. *angustifolium.*
Lflts. broadly elliptic or oblong. Panicle very viscous. Pod over ·6″ diam. . . . . 3. *suaveolens.*
Lflts. as in *tetragona* but tomentose when young, mature pubescent. Panicle hirsute, not viscous. Pod? . . . 4. *chelonoides.*

1. **S. tetragonum,** *DC.* Syn. S. chelonoides, *F.B.I.*; *non* Bignonia chelonoides, *L. f.*; Parari, *Th.*; Patuli, Chui-patuli, Kogari-patuli, *Or.*

A large tree with leaves usually clustered at the ends of the branchlets 12–18″ long with 7–11 glabrous elliptic caudate leaflets 3·5–5″ long with slender petiolules ·3–·7″ long. Flowers yellow and rose-coloured in large glabrous or puberulous panicles with caducous linear bracts. Calyx glabrous ·2–·25″, somewhat irregularly toothed or lobed, not apiculate in bud. Corolla ·7–·9″ long with glabrous or thinly hairy tube outside, anterior surface within more or less villous and woolly round the base of the stamens, upper lobes glabrous or ciliate. Pod long slender 12–20″ long, winged or sub-alate in the northern forms (*tetragonum* proper) and often ·4–·45″ diam. (but with core only ·2–·25″ diam.) or with 4 raised lines and ·3″

diam. in more southern forms. Seeds with their wings 1–1·2″ long by ·2″, easily splitting through the centre, nucleus wedge-shaped.

Northern tract, Champaran and Purneah, *i. e.* not far from the foot of the mountains! Central tract, rather rare and is perhaps a variety or separate species with more slender pod. Valleys in Singbhum! Parasnath, *Anders.*! Puri! Angul! Perhaps other districts but for long confused with the next species.

Fl. April-June. Fr. nearly up to next flowering period. Deciduous.

Bark usually a light brown exfoliating in lighter-coloured patches. Leaflets sometimes serrulate above, sec. n. 6–7 slender, soon reticulate, base rounded cuneate or oblique.

This is the tree usually known as *Stereospermum chelonoides*, *DC.* (see No. 4). *Gamble* states that the wood is moderately durable, elastic and easy to work and is used for building.

2. **S. angustifolium,** *Haines.* Syn. S. chelonoides *var.* angustifolium, *Haines* in *C.P. List*, p. 169; Chuin Patuli, *Or.*

A small tree with usually very nodose branchlets and leaves clustered at their ends. All parts pubescent when young. Leaflets 7–9, oblong or lanceolate-oblong, acuminate but rarely caudate, 3–7″ long or those at base of rhachis very small, usually permanently pubescent on the nerves beneath, sec. n. 6–10 often reddish. Petiolule ·1–·35″ not slender, nor as stout as in next species. Panicle brachiate, lax, pubescent but not very glandular-viscous (as in *S. suaveolens*), ultimate branches 3-flowered. Flowers about 1″ long, purple or with some yellowish streaks. Calyx pubescent ·2–·3″ long, 3–6-lobed or -toothed, apiculate in bud. Corolla nearly glabrous outside, inside densely villous anteriorly but without woolly scales at the base of the filaments. Filaments with very few gland-hairs towards base or glabrous. Capsule terete, 12–16″ long and ·3″ diam. or less, brown and closely lenticellate. Seeds with obtuse or sublacerate wings, much as in last.

Angul! Sambalpur! Fl. April-June. Fr. Oct.–Feb. Deciduous.

In flower (when leafless or nearly so) this is often taken for *S. suaveolens*, but the old capsules, which may nearly always be found underneath the tree if not on it, with their very slender septum ·3″ or less, easily distinguish it apart from the less glandular panicle and usually smaller flowers.

3. **S. suaveolens,** *DC.* Parar, *Th.*; Pader, *H., S.*; Hussi, *K.*; Panrar, *Kharw.*; Paroli, *Mal Pah.*; Parul, *Beng.*; Boro-patuli, Padal, *Or.*

A handsome large or mod.-sized tree with young parts tomentose and glandular. Large leaves with 5–9 broadly elliptic or oblong shortly suddenly acuminate leaflets 3–7″ by 2·5–3″ and dull crimson (yellow-streaked within) very fragrant flowers 1–1·5″ long in large very glandular-pubescent panicles. Capsule 18″ by ·6–·75″ diam., terete, usually purple-spotted and closely lenticellate, often spiral (as also in other species).

In all districts, frequent. In the valleys in hill-districts. Fl. April–May. Fr. Sept.–Feb. Deciduous March.

Bark nearly smooth, grey; blaze pale yellow distinctly narrowly zoned into hard and soft layers. Leaflets sessile or very shortly stoutly petioluled, usually more or less pubescent to maturity, sec. n. 5–12 strong usually, irregular. Calyx ·35–·4″, very glandular, mostly 3-lobed with lower lobe 2-toothed. Corolla villous within on lower side, not woolly at base of filaments, lobes crisped-crenate. Filaments with sparsely gland-hairy base.

Lflts. of the young plants are harsh and spinous-serrate, in quite young seedlings,

simple. The difference in number of sec. n. is remarkable and suggests two species.

Frequently found in grass lands for which it is useful in afforestation. *Gamble* says that "the wood is durable, easy to work and good for building, but that the amount of heart wood is small. Is an excellent firewood and makes good charcoal." I used to find however that it was difficult to utilise it for fuel on account of its being difficult, like *S. tetragonum*, to split. The weight is given as about 40–50 lbs.

4. **S. chelonoides,** *Haines, non De Candolle.* Syn. Bignonia chelonoides, *L. f., vide Kew Bulletin.*

Little is known of the true *Bignonia chelonoides* except from the specimen in the Linnean Herbarium collected at Tranquebar. It very possibly, however, occurs in our provinces, as a specimen very similar to it was collected by me in the Central Provinces.

It is a very pubescent tree with the young parts tomentose and panicle almost hirsute but with the leaflets shaped like those of *S. tetragonum*. The petiolules are not long or slender as in that species but rather short and stout. The fruit is unknown. The flower much resembles our *angustifolium*, which may indeed be only a variety of the Linnean species which should be looked for. The only way to satisfactorily determine the Stereospermums is to mark down flowering trees and therefrom afterwards to collect the mature leaves and capsules.

6. RADERMACHERA, *Zoll. and Moritz.*

Trees with opposite 1–3-pinnate leaves and large flowers in terminal brachiate panicles. Corolla campanulate with very short narrowly tubular base not villous within, limb sub-2-labiate. Stamens didynamous, glabrous, anther-cells divergent or divaricate. Ovary elongate, ovules many-seriate in each cell. Stigma linguiform. Capsule linear, cylindric or sub-compressed, 2-valved, often spiral with coriaceous or woody valves and large sub-terete corky septum. Seeds flat not inserted in deep depressions of the septum, wings without a deep furrow between, cotyledons flat.

1. **R. xylocarpa,** *K. Sch.* Syn. Stereospermum xylocarpum, *Wight*; Khonda-Partoli, *Or.*; Pampani, *Khond.*

A large tree with very large 2–3-pinnate leaves 2–3 ft. long with elliptic to ovate shortly acuminate leaflets 2–6″ long, entire or coarsely serrate, rather pale or silvery beneath. Flowers large, 1·5–2·5″ long, white with yellow or pinkish, sweet-scented, in stout erect rigid ovoid panicles 3–7″ long, the pedicels sub-capitately corymbose on the branches. Pod up to 3 ft. long, woody, tubercled, septum ·5″ broad. Seeds 1·2″ long with the wings.

In the Southern area only and not common. Singbhum, near the Deo River, very rare! Gangpur, *Prain's Collector*! Mals of Puri! Angul (Raigoda, Purnakot and Jacobo forests)! Fl. April–May when leafless. Fr. up to the following April. Deciduous March–May.

Attains 8 ft. girth in favourable situations but usually smaller in our area, with thick light-grey rather smooth and flaky bark and rather thick brown and cream blaze, darkening on exposure. Twigs very stout marked with large leaf scars, leaf buds resinous. Leaves soon glabrous or permanently finely pubescent on rhachis and principal nerves; pinnæ 4–5 prs.; lflts. 3–11, petioluled, sec. n. 4–5, strong beneath, of which 1–2 near base, tertiaries rather strong. Panicle rhachis glabrous lenticellate at base, branches tomentose upwards. Bracts on panicle narrow ·2–·25″, caducous. Pedicels tomentose, ·4–·5″, articulate under the flower. Calyx campanulate, ·3–·5″, puberulous 5-toothed, 2 upper teeth broader and more obtuse, all mucronate.

Gamble states that the wood is good and handsome, it is tough and elastic and takes a good polish. Weight about 42 lbs.

7. DOLICHANDRONE, *Fenzl.*

Trees with pinnate or sub-2-pinnate leaves and entire or obscurely toothed leaflets. Flowers usually white and opening at night, large or mod.-sized, in terminal corymbs or panicles. Calyx spathaceous, split down one side. Corolla funnel-shaped with the lower basal narrow-tubular portion well developed and much exceeding the calyx, limb sub-regular. Stamens included, anther-cells parallel. Disc expanded. Ovary oblong with many ovules several-seriate in each cell. Capsule long linear with coriaceous flat valves; septum narrow with a transverse broader false septum separating the placentæ of each cell, so that the capsule on dehiscence appears septifragal. Seeds almost rectangular with often a thick wing.

Leaflets sub-orbicular or broadly elliptic obtuse or suddenly acute, corolla 2″ long . . . . . 1. *falcata.*
Leaflets elliptic acuminate. Corolla 4–7″ long . . . . . 2. *spathacea.*

1. **D. falcata,** *Seem.*, inc. D. Lawii, *Seem*; Karal, *Or.*

A small or mod.-sized hoary pubescent tree with pinnate or sub-2-pinnate (the secondary rhachis nearly obsolete so that the leaflets appear clustered on a node of the primary rhachis) leaves. Leaflets ·5–1·5″, rarely 2·5″, long, broadly elliptic, obovate, or sub-orbicular, sometimes retuse, more often rounded with a very short acute tip. Flowers very pretty, white in short few-fld. corymbose racemes terminating the new shoots. Calyx ·6-·8″, with stellate pubescence, deciduous. Corolla with slender part of tube ·8–1″ long then widening, limb 1–2″ diam. with crisped rounded or oblong petals. Pod 12–18″ usually much curved, acuminate, glabrescent.

Entering the western districts only in a few places from the Central Provinces where it is common. Sambalpur Range. scarce! Only seen in the Protected forests. Angul, rare, *B. K. Chattarjee.* Fl. April-June. Fr. Feb. Deciduous about Feb.–March.

Bark grey exfoliating in irregular scales. Leaf rhachis 2–5″ with usually 5–7 or, in 2-pinnate leaves, up to 13 leaflets, pubescent or, beneath, often tomentose with forked or stellate hairs, secondary pinnæ usually only from lowest node of primary rhachis and consisting of three leaflets only, petiolules 0–1″ in lateral leaflets, longer in terminal. Corymbs pubescent, sometimes lateral on the old wood.

Beddome says that the wood is used for building and agricultural purposes. It is too scarce in our area to be of consequence.

Var. Lawii. Syn. Dolichondrone Lawii, *Seem.* (sp.).

This is considered by *Brandis* and also by *Sprague* (*vide Kew Bulletin*, 1919, *Dolichandrone* and *Markhamia*) as merely a glabrous form of *D. falcata* and so also it appears to me. It has only been collected in our province by *Kurz* in "Behar"! It is only puberulous on the new shoots and the pods are said to be less curved, but *Sprague* finds that the variation in the indumentum is not correlated with the degree of curvature of the pod.

2. **D. spathacea,** *K. Schum.* Syn. D. Rheedii, *Seem.*

A large handsome tree with pinnate leaves about 12″ long and 7–9 elliptic much acuminate leaflets 2–3″ long, often unequal at the base. Flowers very large 4–7″ long with the narrow portion of tube 3–5″. Capsule 18″ by 1″ nearly straight. Seeds rectangular with corky wings.

Sometimes planted in Orissa and near Calcutta, and may possibly be found wild in the Mahanadi delta, where so many trees frequent in the Sunderbans have been found. Fl. h.s.

The ground of an early morning is often covered with the large white fallen corollas of this tree, which, like so many other species of the genus, is night-flowering. *Sprague (loc. cit.)* gives good reasons (especially the corky seed-wing) for supposing the tree to be disseminated by ocean currents, which makes it the more probable that it will be found in the Orissa swamp forests.

8. SPATHODEA, *Beauv.*

Closely allied to *Dolichandrone* and also has a large spathaceous calyx but differs in the short tubular portion of the corolla, which is very broadly campanulate and anteriorly ventricose above and (in our species at least) brilliantly coloured, and in the absence of the false septum from the capsule.

1. **S. campanulata,** *Beauv.*

A large tree with very pale bark, young parts and inflorescence more or less velutinous, leaves pinnate with about 9 lanceolate leaflets. A beautiful tree in flower, "deciduous for a few weeks in the hot season, after which it breaks into leaf and is subsequently covered for a long period or two long periods by a gorgeous display of large, well-shaped, orange-crimson flowers" (*Firminger*). Spathaceous calyx recurved. Corolla-tube above the short narrow portion very broad, almost ribbed, limb 3–3·5″ diam. of 5 sub-equal ovate-oblong lobes.

Grows well in Chota Nagpur. There is a good specimen at Sakchi in Singbhum. Native of Africa. Fl. h.s. and (*fide Firminger*) also sometimes Sept.–Oct.

9. JACARANDA, *Juss.*

Large trees with generally twice imparipinnate leaves with very numerous more or less trapezoid or rhombic leaflets. Flowers large showy in long loose terminal panicles. Calyx small. Corolla tubular-campanulate with a moderately long narrow basal tube. Stamens included, anthers glabrous with divaricate cells, the staminode very long and clavate at the end with a short 2-lobed hairy tip. Capsule ellipsoid or almost orbicular, woody, compressed at right angles to the septum, loculicidal, each valve carrying with it half the septum.

1. **J. mimosifolia,** *D. Don.*

A very beautiful tree with foliage resembling that of the Albizzias or Acacias, except that the leaves are opposite. It bears panicles of beautiful blue flowers.

Native of Brazil and of somewhat recent introduction, but now becoming common in gardens.

10. PARMENTIERA, *DC.*

Shrubs or small trees with opposite 3-foliolate leaves and flowers clustered on tubercles on the old wood. Calyx spathaceous. Corolla sub-regular, tubular-campanulate. Stamens reaching to the throat of corolla, didynamous with a staminodial fifth. Disc obscure. Ovary 1-celled or at the base 2-celled. Fruit cylindrical, fleshy, indehiscent.

1. **P. cereifera,** *Seem.* The Candle Tree.

A small pretty tree with 3-foliolate leaves with somewhat winged petiole and elliptic leaflets acute each end. Flowers pretty, white or slightly pink. Fruit like drooping clusters of yellow candles hanging from all the branches.

Often grown in gardens. Native of Panama. Fr. h.s.

11. KIGELIA, *DC.*

Trees with odd-pinnate alternate leaves and large red flowers in very loose pendulous racemes from the old wood. Calyx irregularly splitting, coriaceous, 2–5-lobed. Corolla broadly campanulate subregular. Stamens 4 didynamous, the 5th present as a staminode. Ovary 1-celled with prominent parietal placentæ almost meeting at the base. Fruit gourd-like, indehiscent with many seeds embedded in pulp. An African genus.

1. **K. pinnata,** *DC.* Syn. K. africana, *Benth.*

A spreading tree with pinnate leaves and coriaceous obtuse dark-green leaflets. Usually recognised by the racemes of dull liver-coloured flowers hanging by long rope-like peduncles, which sometimes attain 6 ft. in length, and in fruit by the one to four large gourd-like pods at the ends of these. Now frequently planted in gardens, but more curious than ornamental. Fl. h.s.

Crescentia cujete, *L.*, is the Calabash Tree. It bears clusters of flowers on the stems and old branches. The leaves are alternate clustered and simple. The flowers campanulate, greenish-white with dull purple lines. Fruit large globose and the seeds wingless. It therefore departs very widely from the Bignoniaceous type. Sometimes grown in gardens.

FAM. 103. PEDALIACEÆ.

Herbs with the leaves opposite or the upper alternate, often deeply lobed or pinnatifid. Flowers zygomorphic, 2-sexual, solitary or clustered and usually axillary, or racemose. Calyx usually deeply 4–5-lobed. Corolla tubular ventricose, lobes imbricate. Stamens 4 didynamous, only 2 perfect in *Martynia*, a 5th often present as a staminode. Ovary 1–2-celled or finally 4-celled by the growth of a false septum, not deeply lobed; style filiform, stigma shortly 2-lobed. Ovules few or, if many, in one series in each cell, not scattered all over a broad placenta (as in *Scrophulariaceæ*). Fruit capsular or drupaceous. Seeds wingless, albumen 0.

The genus *Martynia* is included in the *Nat. Pflanzenfamilien* in a separate family, Martyniaceæ.

I. Flowers axillary. Stamens 4 didynamous, perfect:—
  Ovules 2 in each cell. Fruit drupaceous, 4-spinous . . . 1. *Pedalium.*
  Ovules many in each cell. Fruit elongate capsular . . . 2. *Sesamum.*
II. Flowers in racemes. Stamens only 2 perfect:—
  Ovules many in each cell. Fruit drupaceous with dehiscent pericarp and crustaceous 2-clawed endocarp . . . . 3. *Martynia.*

1. PEDALIUM, *L.*

Herbs with opposite or alternate toothed leaves and solitary axillary yellow flowers with funnel-shaped corolla suddenly widening from a very small basal tube. Stamens 4 didynamous and a small staminode, included; anther-cells ovate separately pendulous from the top of the connective, opening above by short slits. Disc large oblique. Ovary superior 2-celled, ovules 2 in each cell. Stigma swollen, gibbous at base, acuminate at apex. Fruit drupaceous with 4 spreading spines near base, below which is a solid stipes, above 2-celled. Seeds 2 in each cell.

1. **P. murex,** *L.* Gokara, *Or.*; Bara-gokhru, *Beng.*

A sub-fleshy herb with ascending branches 6–18″ long, repand-dentate alternate leaves 1–2″ long and axillary primrose-yellow flowers 1″ long. Fruit broadly pyramido-conical above the spines, ·3″ diam., succulent with crustaceous endocarp. There are 2 curious button-shaped glands at the insertion of the pedicels which secrete a drop of fluid.

Common on sandy soil near the coast. From Cuttack to Puri! Fl., Fr. Aug.–Oct.

Leaves with minute glistening glands beneath which give the plant rather a fœtid smell; these also occur on the young shoots, pedicels and calyx; otherwise glabrous. Calyx 5-partite, lobes lanceolate, ·07–·08″. Corolla-tube minutely gland-pubescent, broadly tubular beyond the calyx, limb spreading oblique ·75–1″ diam., 2 upper lobes exterior in bud, lobes sub orbicular, 2 upper outer in bud. Filaments thinly glandular-hairy.

The whole plant has the property of rendering water or milk mucilaginous, and the mucilaginous infusion is a valuable demulcent and diuretic, useful in many disorders of the genito-urinary system.

2. SESAMUM, *L.*

Herbs with leaves mostly opposite, upper alternate. Flowers axillary, solitary or few fascicled, short pedicelled. Corolla zygomorphic, tubular-campanulate, slightly gibbous at base, limb 2-lipped with 5 rounded lobes. Stamens included, anthers sagittate. Ovary 2-celled with false septa making it 4-celled when mature. Ovules many 1-seriate in each cell. Fruit a loculicidal 2-valved or finally 4-valved, 4-celled capsule. Seeds obliquely oblong.

1. **S. indicum,** *L.* Tilming, *K.*; Til, *H.*; Rasa, *Or*; The Gingeli-oil Plant.

Erect 1–3 ft. high, more or less fœtid and glandular, usually also pubescent. Leaves simple above, lanceolate or oblong or uppermost linear and alternate, lower opposite often lobed or pedatisect, intermediate usually ovate and gashed or toothed. Flowers purple or whitish with purple or yellow marks, suberect or drooping, 1–1·25″ long, pubescent. Sepals narrow-lanceolate ·2–·25″, hairy. Capsule 1″ long, oblong, bluntly 4-gonous, erect, dehiscent from above downwards, but rarely to the base.

Very widely cultivated in all districts. Fl. Oct.–Dec. Fr. Dec.–Jan. Native country not known with certainty; *De Candolle* thinks it was probably from the Sunda Islands.

Three varieties of seeds are known—black, white and red. The black yields the best oil and is best suited for medicinal purposes. Besides being used in cooking, the oil is emollient, demulcent and laxative. The plant is also mucilaginous and used in bowel affections, *Nadkarni.*

3. MARTYNIA, *L.*

Coarse glandular herbs mostly dichasially branched with opposite broad leaves and drooping red flowers in short racemes terminal and from the forks of the branches. Calyx unequally 5-lobed, slit in front. Corolla tubular-campanulate zygomorphic with broad lobes. Stamens 5 of which the anterior 2 only perfect with long filaments

and confluent anther-cells, the others reduced to staminodes of which the 5th is very rudimentary. Ovary 1-locular with 2 parietal placentæ which are divided towards the middle of the cell into two divaricate laminæ with many ovules 1-seriate on each lamina. Fruit obliquely ovoid, drupaceous with the pericarp finally dehiscent and falling, leaving a crustaceous sculptured endocarp with 2 sharp curved apical spines and a central channel opening between the spines.

1. **M. diandra,** *Glox.* Bilai sarsar, *K.*; Devil's Claw.

A handsome stout clammy-pubescent herb 3–4 ft. high with deltoid-ovate cordate-based sinuate-dentate leaves attaining 6–9″ each way and terminal erect racemes 3–4″ long of drooping pink and dark purple foxglove-shaped flowers 2·5″ long.

In all districts, now thoroughly naturalised! Fl. r.s., Fr. r.s. and c.s. Native of Mexico.

Leaves sometimes broader than long. Corolla glandular-hairy with very oblique mouth; lobes unequal, anterior transversely orbicular-oblong, 1″ wide, lateral semi-orbicular smaller, upper lip somewhat reflexed 2-lobed, anterior surface of corolla within yellow speckled, lobes with a deep purple blotch.

FAM. 104. ACANTHACEÆ.

Shrubs or herbs with opposite* exstipulate simple leaves, often entire, in many genera furnished with linear cystoliths which appear as translucent marks in the fresh leaves and as small raised lines (leaves lineolate) in the dried leaves. Flowers zygomorphous, rarely solitary, usually bracteate and bracteolate. Calyx 5-partite, rarely (*Thunbergia*) of several small teeth. Corolla lipped or subequally 5-lobed, lobes imbricate or twisted in bud. Stamens 4 or 2, inserted on the corolla-tube; anthers 2- or 1-celled, cells sometimes remote or superposed, pollen of very various form and sculpture.† Disc usually conspicuous. Ovary superior, usually elongate, always 2-celled, style filiform, stigma simple or 2-fid (or style shortly 2-branched). Ovules 1–many in each cell, if more than 1 then superposed except in *Thunbergia,* anatropous. Capsule loculicidal, valves often elastically recurved and placentæ sometimes rising elastically from the base when ripe. Seeds usually seated on the hardened curved funicles (*retinacula*) which are frequently produced beyond the hilum into an acute tip, ovoid or orbiculo-compressed, often clothed with elastic hairs which spread out when wetted (hygroscopic). Albumen 0 (exc. in the *Nelsonieæ*).

The venation is normally of several fine somewhat curved sec. n. not reaching but upcurved within the margin, raised beneath, connected by numerous finer

* Leaves alternate in *Elytraria* and some *Staurogyne*, sometimes unequal with the smaller leaf rarely suppressed in a few other genera.

† The form and sculpture of the pollen grains is often indicative of tribes and genera. They are used in classification by *Lindau* (*Nat. Pflanz. Fam.*), but are difficult to describe briefly and are therefore not used here.

nearly straight tertiaries. Glands in the leaf, other than glandular hairs, are very rare. Sessile glands occur in *Cardanthera* among our species. In germination the epigeal cotyledons are usually very well developed, usually broad and rounded and with basal nerves, base sometimes cordate, petiole present where observed.

I. Cystoliths 0. Seeds not laterally compressed, on papillæ (1 to 4) :—
  A. Calyx truncate or with several minute teeth. Ovules 2 collateral in each cell :—
    Usually scandent with palmate venation (exc. *T. erecta*) . . . . . 1. *Thunbergia.*
  B. Calyx 4-5-partite. Flowers in bracteate spikes. Ovules 6-10, superposed :—
    1. Stamens 2 :—
      Spikes slender. Bracteoles small . . . . . 2. *Tubiflora* (*Elytraria*).
      Spikes ovoid or cylindrical. Bracteoles 0. Sepals 4 . . . 3. *Nelsonia.*
    2. Stamens 4. Ovules very many in each cell . . . 4. *Staurogyne* (*Ebermaiera*).

II. Cystoliths often present (leaves lineolate). Seeds laterally compressed on retinacula (exc. *Cardanthera*) (5 to end):—
  A. Corolla-limb 2-lipped or lobes 5 subequal. Lobes twisted in bud (Nos. 5-15) :—
    1. Corolla distinctly 2-lipped. Ovules many in each cell. Flowers in axillary dense cymes or clusters or whorls :—
      a. Glandular herb. Funicles blunt conical. Leaves often pinnatifid or toothed . . . . . 5. *Cardanthera.*
      b. Leaves entire. Retinacula curved :—
        Not spinose. Capsule 8-10-seeded. . . . . 6. *Hygrophilla.*
        Spinose. Capsule 2-8-seeded . . . . . 7. *Asteracantha.*
    2. Corolla sub-equally 5-lobed or 2 posterior lobes more connate :—
      a. Ovules 3-12 in each cell :—
        i. Calyx-lobes rounded. Stamens 2 exserted. Cor.-lobes short rounded. American shrubs or herbs . . . . . *Sanchezia* (p. 672).
        ii. Calyx segments acute. Stamens didynamous :—
          † Flowers in axillary clusters or contracted cymes. Bracteoles small or 0 . . 8. *Hemigraphis.*
          †† Flowers large, solitary or few together or cymose.
            Bracteoles large foliaceous. Capsule clavate . . . . . 9. *Ruellia* (*Dipteracanthus*).
            Bracteoles elongate, narrow. Capsule linear . . . . . (*Euruellia.*)
          ††† Flowers in elongate sympodial cymes.
            Bracteoles minute subulate or 0 . . 10. *Echinacanthus.*
      b. Ovules 2 in each cell :—
        i. Cor. tubular-ventricose. St. 4 (exc. one section of *Strobilanthes*) :—
          † Fls. small (under ·8″ long), somewhat 2-lipped . . . . . 11. *Dyschoriste.*
          †† Fls. large or mod.-sized (over ·8″ long) :—
            Bracteoles very large, reticulate. Anthers spurred . . . . . 12. *Petalidium.*
            Bracteoles linear or 0 (in our species). Anthers muticous . . . . . 13. *Strobilanthes.*
        ii. Corolla with very slender tube scarcely widened above :—
          Stamens 2. Spikes not secund, often corymbose . . . . . 14. *Dædalacanthus.*
          Stamens 4. Fls. clustered between pairs of bracts in secund spikes . . . . . 15. *Micranthus* (*Phaylopsis*).

B. Corolla-limb 2-lipped or lobes 5 subequal. Lobes imbricate in bud (Nos. 16–32):—
1. Ovules 2 in each cell (Nos. 16–30):—
a. Corolla not distinctly 2-lipped (posterior lobes sometimes somewhat smaller than anterior or more connate:—
i. Bracteoles very large, far exceeding the calyx. Calyx-segments 4 . . . . . 16. *Barleria.*
ii. Bracteoles linear or very small. Calyx-segments 5:—
† Stamens didynamous, anthers 1- or 2-celled:—
Spikes often lax, bracts shorter than calyx. Anthers 2-celled . . . . . 17. *Asystasia.*
Spikes with imbricating bracts exceeding calyx. Anths. 1-celled . . . . 18. *Crossandra.*
†† Stamens 2, staminodes often 2. Flowers spiked . . . . . 19. *Eranthemum.*
b. Corolla distinctly 2-lipped:—
i. Stamens didynamous. Bracts often 4-farious:—
† Anterior anthers 2-celled, posterior 1-celled:—
Calyx sub-2-lipped, posterior lip 3-toothed, anterior 2-lobed . . . . . 20. *Neuracanthus.*
Calyx subequally 5-fid. . . . . 21. *Lepidagathis purpuricaulis.*
†† Anthers all 2-celled (exc. *L. purpuricaulis*) 21. *Lepidagathis.*
††† Anthers all 1-celled . . . . . 22. *Aphelandra.*
ii. Stamens 2. Anthers 2-celled:—
† Flowers in spikes or thyrses, rarely (*Jacobinia* spp.) clustered. Bracts often 4-farious:—
! Bracts membranous or hyaline 2- or 4-ranked in secund spikes, if 4-ranked dimorphous:—
Diffuse herbs. Lower anther-cell tailed or muticous . . . . . 23. *Rungia.*
!! Bracts in cylindric or 4-farious spikes (exc. *Jacobinia*), homomorphous:—
* Anther-cells superposed:—
Shrubs or herbs. Fls. small or m.s. Lower anth.-cell white-tailed . . 24. *Justicia.*
Shrubs. Flowers large, corolla-tube short and broad. Lower anth.-cell obscurely mucronate . . . 25. *Adhatoda.*
** Anther-cells parallel sub-equal or one only slightly higher:—
§ Cor.-tube slender. Staminodes 0:—
Shrubs or robust herbs. Fls. usually red, often clustered or in dense cymes or thyrses . . . . *Jacobinia*, p. 694.
Dwarf herb with prettily veined leaves. Fls. spicate, yellow . *Fittonia*, p. 695.
Undershrub. Flowers pale blue in dense bracteate spikes . . . 26. *Ecbolium.*
§§ Cor.-tube widened upwards, staminodes small:—
Shrub with variegated leaves. Fls. in thyrses . . . . . 27. *Graptophyllum.*
†† Flowers in 1-few-fld. cymules. Cymules on the branches of a diffuse panicle or, if clustered axillary, enclosed between a pair of disparous bracts:—
Cymules minute panicled, bracts minute. Fls. white . . . . . 28. *Rhinacanthus.*
Cymules panicled or axillary, bracts exceeding calyx, Fls. rose or purple . . 29. *Peristrophe.*

Cymules usually in axillary cymes. One of the unequal bracts large. Fls. rose or purple . . . . . 30. *Dicliptera.*
2. Ovules 3-many in each cell. Corolla 2-lipped. St. 2:—
Flowers small in sympodial racemose cymes . . 31. *Andrographis.*
Flowers large red in terminal thyrses . . . 32. *Phlogacanthus.*
C. Corolla with a single 3-lobed spreading lower lip, upper obsolete. Lobes inflexed imbricate in bud. Ovules 2 in each cell. Corolla-tube often horny:—
Cor.-tube ovoid or globose. Anther below apex of filament . . . . . 33. *Blepharis.*
Cor.-tube subcampanulate. Anther at apex of filament 34. *Acanthus.*

1. THUNBERGIA, *L.f.*

Climbers, rarely erect, with palminerved often angled and cordate leaves, axillary or racemed large or mod.-sized flowers and large bracteoles enclosing the flower buds. Calyx small annular, usually 10–16-toothed. Corolla with a ventricose curved tube, usually oblique mouth and 5 rounded petals twisted to left in bud. Stamens didynamous, anthers 2-celled, cells sometimes spurred at base, not divaricate. Disc conspicuous. Ovary-cells 2-ovuled. Capsule globose with a flat hard sword-shaped beak. Seeds 2 in each cell, glabrous, often hollowed at the base, sometimes scaly.

I. Climbers:—
A. Flowers axillary:—
1. Flowers white:—
Calyx-teeth lanceolate, ·05–·15″ . . . . . 1. *fragrans.*
Calyx-teeth filiform hairy, ·2–·3″ . . . . . [2. *tomentosa.*]
2. Flowers mostly yellow with dark throat. Garden species. 6. *alata.*
B. Flowers racemed (sometimes also in upper axils):—
1. Flowers blue:—
Leaves broad much dentate 5-7-nerved, pubescent or scabrid . . . . . 3. *grandiflora.*
Leaves narrow 3-nerved, glabrous. Garden species . . 5. *laurifolia.*
2. Flowers orange-scarlet . . . . . 4. *coccinea.*
II. Erect shrub. Flowers purple with white tube . . . . 7. *erecta.*

1. T. fragrans, *Roxb.*

A slender twiner with glabrous or pubescent branches, ovate or oblong, sparsely toothed leaves 1–3·5″ long with straight, cordate or hastate base, and white flowers 1·5″ long, solitary or paired in the leaf axils. Calyx-teeth 14–20 lanceolate or subulate ·05–·07″ long in flower, equalling or slightly exceeding the tube. Capsule ·75–1″ with 4 rounded excavate seeds.

The type occurs in the Sikkim Tarai and probably therefore in Purneah. In it the flowers are fragrant, the capsule glabrous and shining.

Var. lævis, *Clarke.*

Glabrous or grey-puberulous or (in my specimens) distinctly pubescent on young leaves, pedicles, bracteoles and calyx. Pedicels often 2, sometimes 3 in an axil, 1″ to (rarely) 3″, much thickened upwards in fruit (*Clarke*) or uniform (in some of my specimens), flowers not fragrant, capsules grey-puberulous with the calyx teeth up to ·1″ and hardened.

Southern area, frequent. Singbhum, chiefly in Porahat! Angul! Fl. Oct.–Nov. and sometimes to March, fruiting soon after.

Var. vestita, *Nees.* See remarks under *T. tomentosa.*

[2. **T. tomentosa,** *Wall.*]

Similar, but calyx-teeth in flower filiform much longer than the tube, often ·25–·3″, hairy, and capsule villous, beak less flattened.

Chota Nagpur, *Prain*, in Beng. Pl. But *Prain* apparently regards the tomentose form of *T. fragrans* as *T. tomentosa*! There is one specimen only so labelled in the Cal. Herb. The calyx teeth appear to me to be only slightly more narrow than in *T. fragrans*, and even in fruit the whole calyx is only ·15″ long, the teeth being then lanceolate, whereas in *T. tomentosa* they are truly filiform, ·25–·3″ long and hairy. The capsule is shortly villous. It was collected at Bandgaon (Porahat) by *Clarke*, who called it both names, and it exactly matches another named *T. fragrans*, var. *vestita*, to which species and variety I assign it. *T. tomentosa* is a Nilgherry plant which, I may say confidently, does not occur in our area.

3. **T. grandiflora,** *Roxb.*

A large climber with pendant branches and orbicular or ovate, or uppermost lanceolate, leaves 3·5–7″ long and broad, uppermost often passing into bracts. Flowers large light-blue, about 3″ diam., axillary from the uppermost leaves and in racemes. Capsule upcurved on the pendulous branches, 1·5–2″ long with 4-quetrous beak, on clavate pedicels, 1·7–2″ long or pedicel of the axillary flowers attaining 4·5″.

Jungles of northern Purneah! Santal Parganas, base of Rajmahal Hills, *Kurz*! Probably now extinct in the Santal Parganas. Fl. Sept.–Oct. Fr. Nov.–Dec.

Leaves, lower deeply cordate and with triangular lobes, 5-7-nerved, shortly hairy both sides, uppermost glabrous. Bracts, upper small and deciduous, bracteoles ·75–1·5″, falcate-elliptic, often connate on one margin. Calyx a subentire ring. Anthers bearded. Capsule thinly pubescent. Seeds plano-convex or doubly-convex, ·3–·4″ diam, convex side with triangular adnate scaly brown plates.

4. **T. coccinea,** *Wall.*

An extensive climber with long pendant branches, glabrous, elliptic or ovate acuminate entire sinuate or toothed 3–5-nerved leaves and handsome pendulous racemes of scarlet flowers 1″ in diam., mostly fascicled at the nodes of the raceme. Capsule 1–1·6″ long, ·7–·8″ diam., glabrous or minutely pubescent, on pedicels ·5–1·5″.

Damp ravines in the Sameshwar Hills, elev. 1000 ft. and upwards! Fl. Aug.–Jan., also April and perhaps at other times.

Leaves 5–7″, obtuse rounded or cordate at the base. Petiole ·5–2″ or 0 in the uppermost leaves. Racemes often very long with clusters or pairs of flowers rather distant. Bracteoles ·7″ red-purple, often connate along one edge. Calyx a crenulate rim. Corolla with reflexed lobes. Seeds ·25–·3″ diam. sub-plano-convex but raised in middle of plane side, much thicker than those of *T. grandiflora*, somewhat rugose.

All the above are sometimes seen in gardens, more especially *T. grandiflora*. Besides these are found in gardens—5. **T. laurifolia,** *Lindl.*, with light blue flowers similar to those of *grandiflora*, but leaves lanceolate acuminate and up to 9″ long, 3-nerved. Is a native of Burma and the Malay Peninsula.

6. **T. alata,** *Bojer*, which closely resembles *T. fragrans* but is softly villous and has winged petioles and usually yellow corolla with a brown or purple eye or sometimes shades of buff or orange, rarely white. Probably a native of Africa.

7. **T. erecta,** *T. Anders.* Syn. Meyenia erecta, *Benth.*

An erect bushy shrub 3–6 ft. high with rather small ovate acuminate glabrous nearly entire leaves about 1″ long. Flowers purple-blue with white or yellowish tube about 1·5″ long, occasionally white.

Very common in gardens. Fl. principally c.s.

2. ELYTRARIA, *Vahl.*

(Tubiflora, *Gmel.*, is the older name.)

Nearly stemless herbs with alternate crowded radical leaves and small flowers in rigid slender spikes closely covered with spiral imbricate bracts. Bracteoles smaller than the bracts. Calyx sub-4-partite, segments unequal. Corolla-tube linear, limb 2-lipped with 5 oblong lobes imbricate in bud. Stamens 2 perfect, cells 2, parallel sometimes with a minute spur. Ovules 6–10 in each cell, superposed. Capsule ellipsoid acute. Seeds minute, ovoid, reticulate and minutely papillose, not on retinacula.

1. **E. crenata,** *Vahl.* Syn. Tubiflora acaulis, *O. Kuntze* (the older name).

Stem or stock very short, woolly. Leaves obovate or elliptic-obovate 3–8″ long crenate with rounded or obtuse tip, and narrowed at base without any or very short petiole, villous or pubescent on the nerves beneath. Scapes 5–10″, clothed from the base with imbricate acuminate sub-aristate bracts, flowering part 1–3″ with bracts more ovate woolly on the margins. Corolla white or pale coloured ·25–·3″. Capsule ·25″.

It probably occurs in Sambalpur, having been collected by me on dry banks in Raipur (Central Provinces). *Prain* gives Chota Nagpur as a locality, but the sole supposed record is a flowerless and fruitless specimen of *Premna herbacea* from Hazaribagh, the rootstock and venation of which are quite different. There is a specimen collected by *Griffith* marked "Bengal," but this may have been from the (present) United Provinces. Fl., Fr. Oct.–Dec.

Leaves with 4–10 sec. n. according to size, never looped, reticulate near margin and many branches entering the margin.

3. NELSONIA, *R. Br.*

Diffuse herb with opposite entire leaves and very small flowers in ovoid or cylindrical spikes with closely imbricate bracts and no bracteoles. Sepals 4 unequal. Corolla with slender tube inflated at base then deeply constricted and 2-lipped limb with 5 spreading lobes. Stamens 2, inserted above the middle of the tube, anther-cells more or less divergent, or reflexed on a broad connective, sometimes minutely spurred. Ovules 8–10 in each cell. Capsule oblong, barren above. Seeds small, globose or broadly elliptic, not on retinacula.

1. **N. campestris,** *Br.*

A herb sometimes superficially resembling an *Ajuga* or *Prunella* with fleshy sub-tuberous roots, large elliptic-oblong lower leaves (sometimes absent), and pairs or one pair of smaller subsessile ·5–2″ long on the special flowering branches. Flowers blue (purplish rose or white, *Clarke*) or upper lip purple in ovoid or cylindric glandular and villous spikes ·75–2·5″ long. Corolla, throat and palate with curled villi. Capsule ·25″ narrowly conical. Seeds 5–1 in the lower part of each cell, closely minutely granulate.

Common in shady places, sometimes also on banks. Singbhum! Ascends to 2500 ft. at Neterhat, Palamau and Ranchi! Santal Parganas. Probably in all districts. Fl., Fr. Nov.–March.

Shoots densely villous. Stems sometimes 6″ high with leaves attaining 8″ by 3″ or more (var. *vestita* of the Floras, but usually by shady streams and probably the effect of environment on the individual), with some 12–14 distinct slightly curved sec. n. nearly reaching then running parallel to margin and shortly hairy on the underside; in dry places large leaves are usually absent and those on the erect or diffuse flowering stems ·5–2″ long, hairy or villous both sides. Bracts herbaceous ovate glandular ·25″ obtuse. Lowest calyx lobe broadest. Corolla ·12–·25″ long, upper lip erect of 2 lanceolate or oblong lobes usually pale with red purple lines, lower spreading blue with 3 subequal rounded lobes.

4. STAUROGYNE, *Wall.*

(Ebermaiera, *Nees.*)

Herbs or small undershrubs with leaves opposite (or upper alternate in *E. glauca*). Flowers usually small (·5″ or less) in terminal or also axillary spikes or racemes with large foliaceous or small bracts and smaller bracteoles. Sepals 5, subequal or one larger. Corolla long narrow with 5 short patent lobes. Stamens didynamous, included, filaments hairy (exc. *parviflora*), anther cells 2 separate muticous. Ovary with many ovules in each cell. Capsule small oblong with 15–30 globose or cuboid seeds in each cell, hilum a minute hollow, retinacula 0, unripe seeds glandular, finally smooth or with obscure pits.

Flowers sessile or subsessile in our species.

A. Flowers ·4–·5″ long not evidently spicate or in very short rounded spikes . . . . . 1. *glutinosa.*

B. Flowers ·2–·32″ long in elongate spikes:—

Leaves all opposite. Bracts linear or oblong . . . . . 2. *polybotrya.*

Leaves all or the upper alternate. Bracts exceeding the flowers, usually spreading, spathulate . . . . . 3. *glauca.*

1. S. glutinosa, *O. Kntze.*

A diffuse and trailing herb with mostly opposite elliptic or upper oblong obtuse or rounded leaves tapering at the base into a very short petiole, lower attaining 2·75″. Flowers ·4–·5″ long, mostly axillary but upper in very short or rounded spikes. Bracts and calyx viscid-pubescent. Corolla violet-blue with darker veins, pubescent outside, inside with a ring of red hairs at the base of the stamens. Filaments white with red hairs.

In shady places. Akbarpur, Shahabad, *J.D.H.*! Gaya, *Prain* (in Cal. Herb.). Probably also Purneah (Rajshaye!).

Stems 12–18″, trailing, pubescent. L. glabrous or sometimes minutely pubescent, petiole 0–·25″. Calyx nearly ·2″, hairy. Filaments white with red hairs, anther-cells remote on the very broad connective.

2. S. polybotrya, *O. Kntze.*

A diffuse and trailing herb with opposite elliptic ovate or oblong obtuse or subobtuse leaves ·5–1·75″, rounded at base or tapering with a petiole 0–·25″. Flowers ·25–·32″ long, few axillary but mostly in spikes terminating the stems or on axillary branchlets almost bare of leaves at the base. Bracts and calyx more or less viscid-pubescent. Corolla purple with 5 sub-equal broadly-oblong purple lobes, deeper-veined, nearly glabrous. Filaments thinly hairy.

Singbhum, frequent in shady places! Fl., Fr. Nov.–Jan.

Branches adpressed-pubescent, 6–12″. L. pubescent on the nerves beneath. Larger

calyx-lobe ·18″ broader than the others, all gland-pubescent. Filaments thinly hairy. Flowers shortly pedicelled in my specimens (always?). Capsule glabrous narrow-oblong, grooved on two sides, ·17-·18″ long.

3. **S. glauca,** *O. Kntze.*

Habit looks different from at least the upper leaves being alternate, and the lower alternate spreading bracts on the spikes far exceeding the flowers, linear-spathulate.

Found in the Darjeeling Tarai close to our area and may be found in Purneah. Fl., Fr. c.s.

5. CARDANTHERA, *Ham.*

(Synnema, *Benth.*)

Herbs, often glandular hairy and aromatic or fœtid. Leaves opposite, lower often pinnatifid or in water pectinate. Flowers 1–3 axillary or in whorls or spikes, the bract or bracteoles often suppressed. Sepals narrow often unequal. Corolla-tube shorter than calyx, limb 2-lipped, lobes twisted to left in bud, palate transversely plicate-rugose. Stamens didynamous, anther cells parallel, those of the posterior stamens often smaller. Capsule narrow, very many seeded. Seeds small, ovoid, somewhat compressed glabrous or glandular-puberulous. Retinacula inconspicuous, very small and conical, not curved nor hardened.

Some species remind one strongly of Scrophulariaceæ.

1. **C. triflora,** *Ham.*

A glandular-hairy rather fœtid herb 8–18″ high with decumbent and rooting base, membranous broadly oblong-ovate crenate leaves 2–3″ long somewhat decurrent on the short petiole, and purple flowers ·5″ long in axillary sessile 3-fld. cymes, the lateral flowers in the axils of the foliaceous bracteoles of the central flower. Capsule ·25–·3″ long pubescent.

Swampy places, Purneah! Rice-fields, along the Grand Trunk Road (probably Manbhum) *Anders*! Fl., Fr. Aug.–Jan.

Lower leaves sometimes pinnatifid, glandular hairy both sides, lower sometimes pinnatifid. Calyx ·3″, sepals linear-subulate, gland-hairy and also villous at base. Corolla pubescent outside, shorly tubular, then ventricose; upper lip erect, inflated below the flat emarginate or shortly 2-lobed limb, pale; lower lip ·35″ broad, purple with darker veins, sparsely hairy within. Stamens inserted on 2 calli at base of lower lip, anther-cells mucronate at base. Ovary oblong, pubescent above.

It assumes two forms, one smaller with small orbicular or ovate crenate-serrate leaves only ·5-1″ long, the other much larger and coarser with oblong-ovate crenate leaves 2–3″ long and membranous.

6. HYGROPHILA, *Br.*

Herbs. Leaves entire. Flowers sessile in heads or spikes or whorls, with bracts and bracteoles. Calyx 5-fid, teeth narrow. Corolla purple, tube ventricose at the mouth, limb deeply 2-lipped. Posterior pair of stamens sometimes smaller than the anterior or rudimentary, filaments glabrous, anthers oblong, cells equal. Ovary with hairy tip, style hairy, stigma simple linear. Capsule narrow, many-seeded. Seeds ovoid, compressed, elastically hairy when wetted on hardened curved or nearly straight acute retinacula.

A. Prostrate or ascending with small leaves and spiked flowers:—
L. glabrous or puberulous. Posterior stamens rudimentary . 1. *polysperma.*
L. hairy. Posterior stamens with small anthers . . . 2. *serpyllum.*
B. Erect herbs with narrow leaves and flowers in axillary whorls:—
1. Glabrous or nearly so:—
Bracteoles lanceolate acute. Calyx divided half-way down in flower, to base in fruit. Capsule ·5–·55″ . . . . 3. *angustifolia.*
Bracteoles oblong, obtuse. Calyx divided one-third way down in flower. Capsule ·6–·75″ . . . . . 4. *quadrivalvis.*
2. Hairy or villous. L. narrow 4–6″ . . . . . 5. *phlomoides.*

The first two species appear to me more distinct generically than is *Asteracantha longifolia*, which is very closely allied to *H. phlomoides*, and which I have only kept separate in conformity with *Nat. Pflanz. Fam.* and the Flora of Bombay.

1. H. polysperma, *T. Anders.*

A herb with creeping stems sending up erect shoots 4–6″ or sometimes 12″ high, every shoot terminated by a spike ·5–1″ long of elliptic or oblong hairy bracts and bracteoles, the upper bearing small lilac or pink flowers. Leaves at the time of flowering often few, linear-oblong, oblong or ovate, ·5–·8″ or in the larger forms up to 1·5″. Capsule linear-oblong ·25–·35″, 20–30-seeded.

Very common and sub-gregarious in wet places in the damper districts, especially under river banks. Champaran! Purneah! Manbhum, *Ball*! Behar, *J.D.H.*! Bengal (Santal Parg.?), *Kurz*! No doubt in other districts. Fl., Fr. Nov.-Feb.

Stems terete or somewhat angled above, closely puberulous. L. subsessile, usually tapering both ends, puberulous or glabrous, sec. n. 3-4 very fine looped. Bracts foliaceous ·3″ ciliate and puberulous, linear-oblong, tapering obtuse, bracteoles linear (lanceolate, *F.B.I.*), ·2–·25″, pubescent, 1-nerved. Calyx ·2″ villous, lobes linear-subulate, 4 as long as the tube, posterior shorter. Corolla ·3–·32″ pubescent. Two upper stamens reduced to teeth; anthers of perfect ones oblong or sagittate. Ovary oblong. Capsule exceeding the sepals, mostly pubescent towards the tip; retinacula nearly straight.

2. H. serpyllum, *T. Anders.*

A small procumbent herb not unlike *H. polysperma* in general appearance, villous at the nodes. Leaves sometimes pseudo-verticillate (from abbreviated axillary shoots) elliptic-ovate or lower broadly ovate, ·6″ rarely 1″ long, upper lanceolate smaller, loosely pilose. Spikes dense with elliptic bracts ·2–·25″. Flowers ·4″, corolla very distinctly 2-lipped. Stamens with posterior anthers half as long as anterior. Capsule ·17–·2″, seeds 8–10.

Behar, *Kurz*! Sambalpur, Cal. Herb.! Fl. Dec.

Clarke states that the leaves of *H. serpyllum* vary very much in form and indumentum. Possibly too much importance is attached to the character of the anthers in these two species.

3. H. augustifolia, *R. Br.*

An erect or ascending rather strict herb 1–3 ft. high, glabrous below, with long narrow linear or linear-lanceolate leaves 2·5–5″ long, minutely lineolate, tapering both ends, subsessile. Flowers pale purple ·5″ in dense axillary whorls with linear or lanceolate acute bracteoles and finely acuminate hispid-ciliate hairy-tipped sepals connate half-way in flower, divided nearly to the base in fruit, ·35–·5″ long. Corolla ·5–·7″, tube shorter than the calyx. Anthers subequal. Capsule linear ·5–·55″ long, somewhat compressed, 20–30-seeded.

Marshy places, Chota Nagpur, common. Singbhum! Hazaribagh, *Clarke*! Manbhum, *Anders.*! Fls. r.s.-Nov. Fr. Nov.-Dec., the old open capsules can be found in Jan.

4. **H. quadrivalvis,** *Nees.*

Very similar to the last but the leaves often elliptic, or somewhat obovate, bracteoles oblong obtuse, calyx in flower divided only one-third of the way down, strigillose tipped with silky hairs, often not deeply divided in fruit. Capsules erect in very dense clusters at every node, many of which are then leafless, linear ·6–·7″, usually stouter than in *H. salicifolia.*

Marshes, Topchanchi (on borders of Manbhum and Hazaribagh), *Kurz*! Many specimens from Bengal without precise locality! Possibly common, but often confused with the last. Fl., Fr. same time as the last.

Usually a rather coarse herb with 4-sided strigillose or glabrescent stems and leaves often only 1–3″, hairy above. Flowers variable in size, ·5–·7″ long, pale purple. Capsules with 2 gland-like marks at the tip, as in other species but more pronounced.

5. **H. phlomoides,** *Nees.*

An erect rather stout herb 2–3 ft. high with square more or less pubescent or hairy stems, linear-oblong or -lanceolate sessile pubescent leaves 3–6″ long and deeply 2-lipped purple flowers ·8″ long in very dense villous whorls. Calyx ·5″, brown-hairy, teeth linear as long as the tube.

Marshes. Sikkim Tarai and Duars close to our area! Probably in Purneah. Fl. Oct.

Leaves with numerous slightly arched sec. n. as in the last two, but larger and distinctly hairy beneath, outer bracts ovate, ·5″. One sepal often larger than the others in fruit. Corolla-tube nearly as long as calyx, upper lip paler, shortly 2-lobed, lower broader, ·25″ diam., palate plicate, white with purple spots, hairy, very shortly 3-lobed. Capsule equalling the calyx, slightly compressed, 10–12-seeded.

7. ASTERACANTHA, *Nees.*

Herb, spinous at the nodes with narrow pseudo-whorled leaves and rather large whorled flowers with foliaceous bracts and narrow bracteoles. Calyx 4-partite, upper sepal broader. Corolla with upper 2-lobed lip and lower 3-lobed with 2 callosities on the palate. Stamens 4, anther cells parallel, glabrous, muticous. Ovary with only 4–5 ovules in each cell. Capsule narrow compressed 4–8-seeded. Seeds hygroscopically hairy on hard retinacula.

1. **A. longifolia,** *Nees.* Syn. Hygrophila spinosa, *T. Anders.*; Kanta-Kalia, *H.*; Gokhul janum, *S.*

A robust, often gregarious, erect herb 2–4 ft. high with sparsely subhispidly hairy stems, whorled spines often 1″ long, long willow-like leaves and dense spiny whorls of purple lipped flowers 1·25″ long. Capsule ·3″ linear-oblong, shorter than the sepals.

Common along ditches and in marshes, probably in all districts. Fl., Fr. Oct.–Dec.

Leaves sessile, about 6″ by ·6–·7″ or smaller, appearing whorled from the shortened axillary branchlets. Spines usually 6 in a whorl and straw-coloured, very sharp. Calyx silky, posterior sepal ·75″, lateral smaller, anterior 2-toothed. Corolla-tube ·5–·6″, lower lip ·5–·6″ broad with 3 large obtuse lobes, palate yellow with 2 orange ridges.

Sanchezia nobilis, *Hook f.*, is a handsome evergreen shrub with large oblong-obovate leaves 4–10″ long conspicuous for the usually yellow nerves. Flowers 1·8″ long in dense thyrses, yellow with long tube and short rounded lobes and with conspicuous reddish bracts. Common in the moister districts in gardens and plant-houses. Native of Ecuador.

8. HEMIGRAPHIS, *Nees.*

Shrubs, undershrubs or herbs with opp. toothed or sub-entire leaves, and small or moderate-sized flowers sessile in heads or spikes, rarely solitary. Heads terminal or on abbreviated lateral branchlets, with imbricate large 1-fld. bracts; bracteoles small narrow or 0. Calyx 5-partite, segments narrow. Corolla tubular-ventricose or -funnel-shaped; tube long, limb sub-regular with 5 rounded lobes contorted to the left. Stamens didynamous, included or nearly so; anther-cells muticous, bases acute. Style long with one linear and one short lobe. Ovules 3–8 in each cell. Capsule linear or linear-oblong, 6–20-seeded. Seeds compressed discoid, margined, densely hygroscopically hairy.

Leaves ·5–1″ long. Corolla tubular-ventricose . . . . . 1. *hirta.*
Leaves 1·5–4″. Corolla tubular-funnel-shaped . . . . . 2. *latebrosa.*

1. H. hirta, *T. Anders.*

A small prostrate softly hirsute or villous plant with ovate crenate leaves ·5–1·2″ long and small few-flowered heads of pale-blue or lilac flowers with sub-regular corolla ·4–·5″ diam. Capsule ·3–·35″ about 12-seeded.

Anderson describes it as occurring throughout Bengal in grassy places and spreading into the Gangetic plain. It should therefore occur commonly in our area. Yet the only specimens certainly collected inside the province are from Manbhum! and Monghyr, *Kew Herb.*! It is common near Calcutta and probably extends to Cuttack. Fl. March–Aug., expanded only in the early morning.

Generally grey in appearance from the numerous hairs. Leaves rather rugose, obtuse, sessile or subsessile, sec. n. 5. Bracts ·5″. Sepals linear, or spathulate in fruit. Corolla ·5″, ventricose portion nearly as long as the cylindrical. Longer filaments laxly hairy below, glabrous above.

2. H. latebrosa, *Nees.*

A diffuse or erect softly hairy herb attaining 12–18″ in height with long-petioled coarsely toothed ovate leaves 2–4·5″ long and pretty bright-blue flowers ·3″ diam. in capitate or subcapitate bracteate spikes. Corolla curved or nearly straight ·7–·75″ long. Longer filaments densely bearded by long white papillose hairs, shorter glabrous. Capsule ·25–·3″ "minutely pâtently hairy, 6-seeded" (*Clarke*).

Common, chiefly in rocky places under shade. Monghyr Hills, *Cal. Herb.*! Singbhum, Hazaribagh and Palamau, common in rocky jungles! Santal Parg.! Puri! Sambalpur! Therefore probably the whole of the Central and Southern areas. Fl., Fr. Nov.–Jan.

Stems 4-angled, patently hairy. Leaves crenate-dentate acuminate, base suddenly contracted on the petiole, sec. n. about 6 distinct but fine. Petiole 1–2·5″. Small axillary branchlets bearing terminal heads often have very small leaves. Bracts ovate or elliptic, petioled, about ·3″ but variable in size. Sepals ·2–·25″, linear-lanceolate, hairy, pale. Corolla-tube sometimes yellow, lobes of limb rounded, always pure blue.

Most of the Chota Nagpur specimens apparently belong to *Clarke's* variety **rupestris,** described as "more pubescent, often viscid aromatic, heads denser." It is said to be more rigid and growing in drier places.

9. RUELLIA, *L.*

Herbs or undershrubs with opposite, rarely 3-nate, entire or undulate, lineolate leaves and usually large, solitary, clustered (or cymose in some exotics) flowers subtended (Sect. *Dipteracanthus*) by two large foliaceous bracteoles (or bracteoles narrow in some exotic species), bracts 0 (in indigenous species). Calyx 5-fid or -partite with narrow segments. Corolla tubular-ventricose with the narrow portion of tube short or very long, lobes sub-equal rounded. Stamens didynamous, anthers subequal short with 2 oblong muticous glabrous cells. Ovary glabrous, style long, hairy; stigma simple, the posterior lobe being suppressed or nearly so in indigenous species. Ovules 3–10 in each cell. Capsule clavate with solid base (Sect. *Dipteracanthus*), or linear and seed-bearing nearly the whole length. Seeds large, thinly discoid, marginate, densely hygroscopically hairy, on strong hooked retinacula.

The Indian species all belong to Sect. *Dipteracanthus*; some exotic species are, however, found in gardens.

I. Sect. *Dipteracanthus*. Bracteoles large foliaceous. Capsule clavate with solid base :—
- A. Creeping or rambling. Fls. ·9–1″ . . . . . 1. *prostrata*.
- B. Erect, or sometimes stemless :—
  - 1. Corolla 1–1·5″, white with pink or purple marks . . 2. *cernua*.
  - 2. Corolla over 1·5″, colour uniform :—
    - L. ell. or oblong rounded, petiole short. Fls. white . . 3. *suffruticosa*.
    - L. ell. or lanceolate long acuminate, petiole slender . . 4. *Beddomei*.

II. Sect. *Euruellia* (*Cryphiacanthus, Nees*). Bracteoles narrow, capsule linear, seed-bearing throughout :—
- Root tuberous. Fls. cymose, large, blue. Exotic . . 5. *tuberosa*.

1. R. prostrata, *Poir.*

Creeping and rooting at the nodes, scarsely suffruticose, or rambling (see var.) with ovate leaves mostly ·5–1·5″ long and axillary solitary pretty purple or white flowers ·5–·75″ diam. and about ·9–1″ long. Capsule ·8″ hairy pubescent or puberulous, empty basal portion about ·3″. Seeds over 12, ·12″ diam.

In moist shady places, banks, etc., throughout the area. Darbhanga! Purneah! Monghyr, *Cal. Herb.*! Chota Nagpur, all districts! Orissa! Kalahandi! Fl., Fr. chiefly r.s. and c.s.

Stems pubescent or nearly glabrous except at the nodes. L. obtuse or acute more or less hispid or hairy, especially on the 5–7 sec. n. beneath. Petiole short or lower ·5″. Flowers caducous sessile or subsessile with bracteoles very short-petioled like leaves ·3–·4″ long. Sepals mostly ·25″ in flower, sometimes ·4 in fruit, subulate-setaceous, hairy. Corolla caducous, falling before mid-day, narrowly tubular for ·25″, then ventricose. Ovary downy.

Var. **dejecta,** *Clarke.*

Rambling and clambering among bushes. Branches with very long internodes, sparsely pilose or upper side tomentose. L. 1–2″, ovate or elliptic, acute, base rounded or narrowed into the ·2–·5″ petiole, hairy.

Very common in the open scrub jungles of Puri! Fl. April-May (as well probably at other times).

2. R. cernua, *Roxb.*

Roxburgh's description is as follows: Shrubby, erect, polished. Leaves drooping, petioled, ovate-lanceolate, acuminate. Flowers axillary, subsessile. Bracts petioled. Capsule clavate, many-seeded.

Reared in the Botanic Garden at Calcutta from seed sent by *Dr. Buchanan* from Mysore, where the plant is indigenous. Flowering time in Bengal the rainy season.

Branches opposite, alternately smaller, suberect, smooth, obscurely 4-sided, the whole plant about 3 ft. high. L. alternately smaller, slightly repand, recurved, smooth, size very various, the larger often from 2–4″ long. Flowers axillary, from 1–3, subsessile, small, pale pink, their insertions surrounded with some opposite pairs of small floral leaves and lanceolate petioled bracts. Corolla campanulate, lower lip larger and more deeply coloured, the other four equal. Stigma clavate, curved.

Anderson, followed by *Clarke* in the *F.B.I.*, and also by *Prain*, identifies the plant described by me under *R. Beddomei* with the above. There is a good plate of *Roxburgh's* plant in his unpublished drawings, and the identification either by his description or the plate appears to me untenable, as I have before observed in my *Fl. Ch. Nag.* In the drawing further points of difference appear: the bracteoles are shown as toothed, tapering into a broad petiole, the flowers only ·7″ long, corolla under ·5″ diam., white with pink markings. The Parasnath plant never varies in this connection, and when fading to white it always does so uniformly without traces of pink or other markings. The specimen identified by *Anderson* with *Roxburgh's R. cernua* is in the Calcutta Herb. Although the shape of the leaves is similar, they are densely hairy when young and somewhat hairy when old.

3. **R. suffruticosa,** *Roxb.* Brunaia, Charpatu, *K.*; Chaulia, Ranuran, *S.*

A perennial herb, scarcely suffruticose, with many long slender tuberous roots. Stems 0–12″, rarely more, high. Both stem and leaves with many white hairs. Leaves oblong or broadly elliptic, rounded or obtuse at the tip, 2–5″. Flowers pale-purple or usually white 2–2·25″ long and 1–1·25″ diam., opening at night and soon falling in the morning. Capsule ·6–·75″ long with 12–14 thinly discoid marginate seeds.

Very common in the hills of the Central Area and Southern Area. Santal Parg.! Chota Nagpur, all districts! Nilgiri and Mayurbhanj, common, and probably common throughout Orissa! As it occurs also in Oudh and the Central Provinces it will probably be found in Champaran and the whole of the western districts. Fl. May–Sept. Fr. Aug.–Oct. Dies down to the root in the cold season.

Often forming a rosette with scarcely any stem after jungle fires in May, the stem usually elongating in the rainy season but not usually over 8″ (up to 2 ft., *Clarke*). Whole plant very hairy. L. often only 1·5–2″ long when first flowering. Petiole ·12–·5″. Peduncles shorter or longer than the leaves, the two foliaceous bracteoles at top ·6–·8″ long, obtuse, subsessile. Sepals ·2–·25″. Narrow part of corolla-tube ·7–1″, lobes ·3–·4″ diam., rounded.

It is one of the herbs known collectively as *Ili-ranu* (rice-beer medicine) by the Kols, by whom it is used in the process of fermentation of rice-beer (Ili, *K.*; Handi, Handia, *S.*, *Uran*). The root is the part used; it is boiled and then mixed with *chunam*. *Campbell* says that the root is used in gonorrhœa, syphilis and renal affections.

4. **R. Beddomei,** *Clarke.*

A strict erect herb, scarcely suffruticose, 1–3 ft. high from a slender woody stock, with obtusely 4-gonous and grooved, smooth or minutely strigose stems, elliptic to lanceolate mostly long-acuminate, thinly hairy, leaves 2–5·5″ long and light purple sessile flowers 2–3·3″ long with petioled, elliptic or ovate, acute or acuminate leafy bracteoles. Capsule ·7–1″ clavate smooth. Seeds usually 4 (up to 8) in each cell, white-margined with dense felted hairs.

Common in the forests under light or moderately dense shade. Chota Nagpur, all districts, ascends to 3000 ft.! Sambalpur! Probably throughout the Orissa Mnts. Fl. Aug.–Dec. Fr. Nov.–Dec.

Stem sometimes sparsely hairy above. Leaves densely lineolate, base rather suddenly narrowed to and somewhat decurrent on the ·5–1·2″ long slender petiole, sec. n. 6–7 curved forward within the margin, raised beneath and united by numerous tertiaries. Bracteoles about 1″ long including the petiole which is half to three-fourths as long as blade, sometimes lanceolate. Sepals nearly free, ·6–·7″, with setaceous tips as long as the blade, strongly ciliate and lineolate, with strong midrib adpressedly hairy. Corolla pubescent except on the lobes within, narrow part of tube very slender and up to 1·5″, limb up to 1·75″ diam. with orbicular-oblong lobes.

5. **R. tuberosa,** *L.* Syn. Cryphiacanthus barbadensis, *Nees.*

About 1 ft. high, much branched from a rootstock of numerous fleshy tubers, nearly or quite glabrous. Leaves elliptic-obovate 2–4″ often undulate-crenate, shortly petioled. Flowers deep blue, handsome, in axillary and terminal cymes. Bracts and bracteoles narrow. Calyx ·5″, glandular, cut to base into subulate filiform tipped segments. Capsule linear ·8″.

Frequent in gardens and often spreading naturally. Native of tropical America. A very pretty plant but the flowers all fall off before mid-day.

10. ECHINACANTHUS, *Nees.*

Herbs or undershrubs with opp. sub-entire or toothed leaves. Flowers often showy, cymose, cymes axillary and forming a terminal panicle, bracts small, linear, bracteoles small or 0, pedicels short or 0. Sepals 5, long, linear. Corolla tubular-ventricose, narrow tubular portion about equalling the widened part, lobes 5 subequal, rounded. St. didynamous included; anther cells 2 oblong parallel, base spurred or muticous. Ovary with linear style and simple stigma. Ovules 6–8 in each cell. Capsule oblong or linear, 8–16 seeded, nearly from the base. Retinacula normal. Seeds compressed, discoid, densely hygroscopically hairy.

1. **E. attenuatus,** *Nees.*

A pretty perennial herb 1–2·5 ft., glandular-pubescent above, with subtuberous roots and with (or without when in flower and fruit) large radical leaves 6–9″ long, cauline gradually smaller upwards and passing into the glandular-pubescent linear bracts of the inflorescence. Flowers violet 1·25″ long in axillary panicled lateral spreading spiciform cymes, on the rhachis of which they stand vertically. Capsule ·65–·75″, narrowly oblong or linear-lanceolate with a solid base under ·1″ long, glabrous, 4-valved.

Common in Sal forest on white loam in the Northern Champaran forests! Fl. Nov.–Dec.

Stems glabrescent below. Leaves elliptic oblong below to lanceolate or oblanceolate above, glabrous, entire or mostly shallowly dentate or sinuate acute, base narrowed into the winged petiole; sec. n. about 12 looping at their ends. Spikes few-flowered, upper forming a terminal panicle. Sepals ·5″, erect. Corolla with slender part of tube included, venose, lobes ovate obtuse. Filaments and anthers hairy, cells tailed. Ovules 6-7 on each placenta.

11. DYSCHORISTE, *Nees.*

(Calophanes, *D. Don.*)

Perennial herbs or undershrubs. Leaves opposite. Flowers in axillary clusters or contracted cymes, bracteoles small. Calyx lobes 5 subequal, narrow. Corolla obscurely 2-lipped, lobes spreading, twisted to left in bud. Stamens didynamous, anthers similar, cells parallel, minutely mucronate or spurred, pollen globose, ribbed. Ovary glabrous, ovules 2 in each cell. Stigma linear, recurved, upper lobe rudimentary. Capsule oblong, base contracted, solid. Seeds 4 orbicular, much compressed, with hygroscopic hairs, retinacula strong.

Calyx ·5–·6″. Corolla ·75–·8″, blue . . . . . 1. *vagans.*
Calyx ·25–·3″. Corolla only slightly longer, purple . . . . . 2. *depressa.*

1. **D. vagans,** *O. Kuntze.* Syn. Calophanes vagans, *Wight.*

A branched sub-diffuse undershrub 1–3 ft. with minutely strigose obtusely 4-anglar stems, lanceolate or ovate acute or sub-acuminate leaves 1·5–3″ long narrowed into a short petiole, and pretty blue-lipped flowers in axillary and subterminal clusters.

In the Central Provinces frequent up to our borders (!), which I believe it crosses in Sambalpur, though I can find no Sambalpur specimens. Fl., Fr. Nov.–Dec.

Leaves pale beneath and glabrous or puberulous, minutely hispidulous above, sec. n. 6–8 fine but distinct, running close up to margin. Clusters or cymes glandular-pubescent, often few-fld., bract and bracteoles linear, not half as long as calyx. Calyx ·5″ sub-2-lipped with subequal filiform-tipped teeth and stalked glands. Corolla ·7–·8″ or tube not much exceeding the calyx, ventricose above with the ventricose part keeled beneath and transversely rugose, lobes subequal, oblong, truncate or slightly retuse, palate purple-bullate between the ribs, yellow in the tube or throat. Filaments and anthers shortly hairy, anther-lobes all spurred. Style simple, gland-hairy. Ovary oblong.

2. **D. depressa,** *Nees.* Syn. Calophanes Nagchana, *Nees.*

Stems somewhat woody at the base, numerous, often prostrate, 4-angular above, minutely pubescent. Leaves ·5–1·5″ obovate or elliptic, densely minutely lineolate above, attenuate at base into a 0–·2″ long petiole, sec. n. 3–4. Flowers much smaller than in *D. vagans* ·3–·4″ long, clustered axillary or on very short axillary peduncles with a pair of small leaves, pedicels hardly any. Calyx ·3–·35″ minutely strigillose or lineolate, sepals connate about half-way then produced into long setaceous tips of which midrib is decurrent on the tube. Corolla somewhat shorter than or only very slightly exceeding the calyx, purplish, tube about ·15″, lobes oblong rounded. Stamens didynamous, one short and one long filament from each pair united at the base into a flattened pubescent plate, anther-cells spurred. Capsule ·34″ long.

Rare in our area. Behar, *J.D.H.*! Patna, *Ham.* (*Wall.* No. 2396)! Fl. March.

12. PETALIDIUM, *Nees.*

Shrubs or undershrubs with entire or somewhat toothed leaves and large or mod.-sized (white, in our species) shortly pedicelled flowers axillary or in contracted spikes (or cymes?),* often crowded on

* The inflorescence is described usually as cymose, but it is, I think, always racemose.

abbreviated lateral branchlets, sometimes spikes (or cymes ?) reduced to single flowers; bracts narrow or 0, bracteoles large ovate reticulate, at first foliaceous ultimately scarious. Calyx 5-partite, segments subequal, very narrow. Corolla straight or curved, tubular-ventricose, narrow part of tube short or (not in our species) longer than the ventricose portion; lobes 5 subequal. Stamens didynamous, anther cells 2 parallel, spurred or muticous; pollen ellipsoid, few-ribbed, opercula 3 with usually a tubercle above and below each. Ovules 2 in each ovary-cell. Style long, stigma-lobes 2 unequal. Capsule clavate, compressed. Seeds discoid, hygroscopically hairy, on placentæ which separate elastically from the bottom of the capsule.

1. **P. barlerioides,** *Nees.* Malpi, *Or.*; Divari, *Gond.*

A straggling shrub 2–5 ft. high with straw-coloured twigs and ovate, toothed or crenate acuminate puberulous leaves, often very few at the time of flowering, 2–4″ long or up to 6″ by 4″ with the base suddenly decurrent on the long petiole. Flowers white 1·3–1·5″ long sub-solitary or in opposite decussate pairs in dense or sub-capitate spikes (abbreviated lateral branches) with large green-veined bracteoles ·7–·8″ long, scarious in fruit. Capsule ·5–·6″ glabrous, clavate, cuspidate. Seeds "usually 2" (*Cooke*).

Common in the Central and Southern areas, especially in rocky jungles. North Champaran, rare! Singbhum, common! Hazaribagh (common in Koderma and on Parasnath)! Palamau! Santal Parg.! Rocky ghats, Narsingpur! Mals of Puri! Angul! Sambalpur! Patna State, *Grieve*! Kalahandi, *Cooper*! Fl. Feb.–April. Fr. April–May. Deciduous in the h.s. or nearly so.

Young shoots and leaves pubescent. Leaves with 6–8 sec. n. and fine cross tertiaries. Petiole about 2″ in larger leaves. Calyx very glandular hairy ·4–·5″. Corolla with narrow tube ·3″ long and very venose ventricose portion, strongly ribbed lower lip and fulvous hairs within. Anthers with long spurs.

13. STROBILANTHES, *Blume.*

Shrubs, undershrubs or herbs with opp. often unequal, toothed or subentire usually lineolate leaves. Flowers usually moderate-sized, spicate, capitate or panicled. Bracts and bracteoles large, small or 0. Calyx deeply 5-fid, segments narrow, usually subequal. Corolla tubular-ventricose, straight or curved, with 5 rounded subequal lobes contorted in bud. Stamens didynamous or (in one section) 2; anthers oblong, 2-celled, muticous. Disc small or prominent. Style linear, stigma of one linear-lanceolate lobe, the other obsolete. Ovules 2 in each cell. Capsule 4- or 2-seeded, placentæ rarely rising elastically from the base. Seeds much compressed, glabrous or hygroscopically hairy, on strong curved retinacula.

The genus is remarkable in several species which only flower periodically and more or less gregariously and then die. The nervation is fairly constant, consisting of many slightly arched secondary nerves running obliquely nearly to the margin and then turned up parallel to it for a short distance; the sec. n. are united by numerous scalariform tertiaries a good deal fainter than the secondaries.

Strobilanthes is a large genus not well represented in our area, but at least two species occur, one on the mountains of Mayurbhanj and one in the Ramnagar Hills, which I have not seen in flower and have been unable to identify. Several other species also occur in cultivation. One of these, *S. Dyerianus*, is remarkable for the purple and metallic bronze tints of the foliage.

A. Flowers in dense spikes:—
Fls. yellow. L. hard, tapering at base, ell. or obovate . . 1. ***scaber.***
Fls. blue. L. soft, auricled at the base. . . . . 2. ***auriculatus.***
B. Flowers not seen. Determination uncertain:—
L. softly hairy, ovate, 3-6″ long. Petiole 1-1·5″ hairy . . 3. ***jeyporensis?.***
L. glabrous, narrowly lanceolate, 3-5·5″. Petiole ·5-1″ . . 4. *?*

1. **S. scaber,** *Nees* (in part).

A somewhat harsh herb 1-3 ft. high with creeping rootstock, hispid or strigose stems, opposite rather stiff or hard entire or crenate elliptic or obovate scabrid leaves 2·5-6″ long, and bracteate capitate spikes of yellow tubular flowers 1″ long and about ·6-·7″ diam. Spikes often in short terminal panicles. Capsule ·3″ (nearly ·5″, *Clarke*), downy, usually 4-seeded.

Often sub-gregarious under shade and in wet places, along watercourses, etc. Purneah, probably (it occurs close by in Maldah!); Santal Parg.! Singbhum! Puri, very common in the Mals! Sometimes cultivated. Fl., Fr. Jan.–April.

Not very characteristic of the genus. Leaves hispid or scabrous beneath, lineolate with short raphides above, rather grey above and glaucous beneath, tapering both ends; sec. n. 6-8, tertiaries rather reticulate. Petiole ·3-·8″. Spikes 1-1·5″ on hairy peduncles, lanceolate bracts ·7-1·25″ long, remarkable for their long tapering but rather blunt tips, very hairy. Bracteoles linear, ·5″. Sepals linear, ·5″, with long often glandular hairs. Corolla narrowly tubular for ·25″ then ventricose, villous within. Filaments hairy. Seeds discoid with broad margins and long silky hairs, " with very large glabrous areoles, " *Clarke*. I have found the capsule rarely 6-seeded!

2. **S. auriculatus,** *Nees.* Hutid, *K.*; Gada Kalha, *S.*; Marmari-dara, *Gond.*

A shrub 2-6 ft. high, often gregarious, with sessile leaves auricled at the base, those in a pair usually unequal, the larger ones 5-10″ long, soft, hairy, crenate. Flowers about 1″ long, blue, in axillary and terminal linear spikes 1-3″ long with densely imbricate obovate obtuse bracts with recurved margins densely covered with stalked glands beneath. Corolla 1″ curved so that the mouth is sub-lateral, the narrow tubular portion only ·25-·3″ long then ventricose. Capsule ·3″ glabrous.

Frequent under shade in the forests and often forming a dense undergrowth under Sal in Singbhum. N. Champaran! Gaya Ghats! Jaspur, rocky hill tops, *Wood*: Singbhum, often gregarious! Manbhum, very common on the banks of nalas, *Campbell*! Hazaribagh! No notes of it from Orissa, though it surely occurs there. Fl. Nov.-Feb. Fr. March-April. But only flowers periodically, the periods about six years. I have records of a general flowering in 1898 and 1911, but an odd plant or so may be found in flower most years, especially near the six-year period. It is exceedingly beautiful when in full flower, colouring the shades of the forest with a sheet of blue, and it is sometimes cultivated in plant-houses.

Branches nearly glabrous, angled, angles obtuse below, acute above. Leaves often oblique or slightly falcate, lanceolate or oblanceolate (oblong or ovate, *Clarke*), acuminate, narrowed at the base and again slightly widened at the auricle, thinly hairy above and puberulous on the nerves beneath, sec. n. 9-12. Spikes very numerous, terminating short axillary branchlets. Bracts ·25-·3″, broader than long, densely hoary pubescent or (Var. **Edgeworthiana**) with long spreading white cilia. Bracteoles 0.

The variety *Edgworthiana* is more common in Chota Nagpur than the type. The sepals have also long white cilia at the tip.

A form with prettily white-variegated leaves is often met with (Koderma, etc.).

3. **S. jeyporensis,** *Bedd.*?

A gregarious shrub 4-6 ft. high with large softly hairy leaves often with a purple tinge. Flowers not seen.

Mayurbhanj, Simlipahar Mnts., elev. 4000 ft. !

Mr. Gamble has kindly matched this plants with a similar one collected by him on Mahendragiri, 4000 ft. (Ganjam), and identifies it as *S. jeyporensis*. The branchlets in our specimens are angled and nearly glabrous. Leaves 3-6″ long, ovate or ell.-ovate, hairy and densely lineolate above, paler and hairy on the nerves beneath, crenate or crenulate-dentate, scarcely acuminate, rounded at base or suddenly shortly decurrent on petiole, sec. n. 9-12 distinct both sides, rather strong, running nearly to margin then upcurved for some distance parallel to it, tertiary nerves numerous close parallel scalariform. Petiole of larger leaves 1-1·5″, sparsely villous.

According to *Clarke* in *F.B.I.* the flowers of *S. jeyporensis* are white, in linear-oblong viscidly patently hairy spikes with lanceolate acuminate recurved bracts ·7″ long. Calyx ·5″ and more with segments linear from a short lanceolate base, patently hairy. Corolla nearly straight with ventricose portion of the tube much longer than the cylindric. Ovary 4-ovulate in *Beddome's* figure.

4. **S. sp.?**

A shrub 3–4 ft. high. Branchlets glabrous 4-grooved. Leaves lanceolate tapering both ends 3·5-5·5″ by ·8–1·3″, acuminate entire glabrous except on midrib beneath which is minutely pubescent, sec. n. 9–10 oblique nearly to margin then running parallel within it for some distance, tertiaries sub-scalariform not very strong. Petioles ·5–1″ slender.

Ramnagar Hills! Probably flowers in the r.s.

14. DÆDALACANTHUS, *T. Anders.*

(Eranthemum, *L.*, in *Nat. Pflanz. Fam.*)

Shrubs or undershrubs, more rarely herbs with usually 4-angled branches opp. entire or obscurely toothed lineolate leaves and usually showy flowers in spikes, heads or corymbs. Bracts usually large, bracteoles narrow, shorter than the calyx. Calyx lobes narrow. Corolla with slender tube, widened only near the mouth; lobes obovate, rounded, twisted to left in bud. Stamens 2 glabrous. Anthers narrowly oblong, 2-celled, exserted or subincluded; pollen spherical, honeycombed. Style long, glabrous or sparsely pubescent, stigma simple, linear. Capsule clavate, with solid terete base. Seeds compressed discoid, hygroscopically hairy on acute retinacula.

Lindau includes this genus in Eranthemum, which it very closely resembles, and can only be distinguished by the twisted (not imbricate) corolla lobes in bud, and usually by the bracts much exceeding the calyx.

I. Bracts imbricating, foliaceous, often white, very nervose:—
  Bracts ·5–·75″, cuspidate. Flowers blue . . . . . 1. *nervosus.*
  Bracts ·6–1″, long-acuminate. Flowers lilac or purple . . 2. *purpurascens.*
II. Bracts rather distant, linear or lanceolate-linear:—
  Bracts ·5–·6″. Flowers blue-purple or slate-coloured . . 3. *montanus.*

Several species (including *nervosus*) are cultivated. One of these, *D. splendens*, *T. Anders.*, with brick-red curved flowers, is common in the lower Himalaya close to our area.

1. **D. nervosus,** *T. Anders.*

A handsome shrub 2–6 ft. high with 4-angled puberulous branches, large soft deep-green leaves 5–9″ long, elliptic to ovate, acuminate, with tapering base. Flowers pure blue 1–1·25″ long and ·75″ diam. in ternately sub-corymbosely panicled terminal spikes with mostly white, green-veined imbricating bracts about ·5–·75″ long, mostly

oblong-obovate obtuse with a sharp cusp. Capsule ·6″ long, glabrous, with short point.

Forests of N. Champaran, under shade! Singbhum, in ravines, not uncommon! Mountains of Mayurbhanj, under shade! Fl. Jan.–March. Fr. April–May.

Leaves sometimes obscurely crenate-dentate, with a curly pubescence on the strong oblique sec. n. when young, sec. n. 7–12. Petiole ·5–1·5″. Spikes 1–3″ long. Bracteoles and calyx scarious, ·25–·3″ long, minutely pubescent. Corolla-lobes ·25–·3″, broadly elliptic. Anthers exserted.

2. **D. purpurascens,** *T. Anders.* Gulsham, *H.*

An undershrub 2–4 ft. high with 4-angled stems and minutely pubescent branches, large elliptic or ovate acuminate leaves up to 7″ by 4·5″ with the base decurrent on the petiole. Flowers lilac or rose-purple 1·25–2″ usually in numerous dense long-peduncled axillary spikes or terminal spikes ternate but not in corymbs. Bracts close ovate or rhomboid tapering into a long acumen, usually pale, very prominently veined. Capsule ·5–·7″.

In hilly tracts throughout the area from the Monghyr hills southwards! Chota Nagpur, common in the valleys but does not demand such dense shade and moisture as the last species! Angul! Sambalpur! Kalahandi, *Cooper*! Fl., Fr. Jan.–June.

Leaves glabrous or somewhat pubescent beneath, closely lineolate, sometimes distinctly crenate-dentate, usually sub-entire, sec. n. 6–9 rather strong, arched. Petiole sometimes hardly any in upper, up to 1·5″ in lower leaves. Terminal peduncles often 3–4″ long. Spikes 1·5–3″. Bracts usually pubescent beneath and ciliate, but an eciliate variety occurs, lower sometimes interrupted and 1·5′ long but usually all imbricate, often whitish between the green nerves Calyx ·25″. Corolla-tube pubescent, anthers sub-included.

3. **D. montanus,** *T. Anders.*

An undershrub 2–3 ft. high with 4-angular branches usually closely puberulous and glandular upwards (white-hairy, *Clarke*). Leaves broadly ovate or ovate, shortly acuminate, 2–5″ long, decurrent on the petiole from a broad base, minutely pubescent on the nerves beneath. Flowers blue-purple or often almost slate-coloured, in numerous linear spikes 3–4″ long, solitary lateral and frequently in terminal panicles. Whole inflorescence densely covered with stalked viscid glands with a strong aromatic smell. Bracts linear or linear-lanceolate ·5–·6″, bracteoles linear about half as long. Corolla-tube 1·2″ long, limb 1″ diam. Capsule ·5–1″. Seeds ·1″ long, round-elliptic, brown, margined.

Chota Nagpur, rare. Tongo (Ranchi), *Bresser*! Puri jungles! Narsingpur! Fl., Fr. Oct.–March.

Easily distinguished from the other wild species by the very narrow laxer spikes and bracts and the aromatic glands. *Clarke* (*F.B.I.*) states that it is very variable.

15. MICRANTHUS, *Wendl.*

(Phaylopsis, *Willd.*)

Perennial herbs with opp. entire or obscurely crenate leaves and small flowers in dense terminal secund spikes consisting of pairs of imbricate bracts with a sessile cyme or cluster of 3–4 flowers between each pair; bracteoles 0. Sepals 5, one large ovate, nerved; the others smaller, narrow. Corolla with slender tube, lobes 5 slightly unequal, rounded, contorted in bud. Stamens didynamous, anther-cells 2 parallel shortly oblong, minutely mucronate at base. Style long hairy, upper lobe of stigma small or rudimentary. Ovules 2 in

each cell. Capsule clavate, compressed parallel to the septum. Seeds discoid, hygroscopically hairy; placentæ separating elastically from the base of the capsule.

1. **M. oppositifolius,** *Wendl.* Syn. Phaylopsis parviflora, *Willd.*

Herbaceous undershrub with somewhat creeping slender rootstock and ascending angled stems 1–3 ft. high, sometimes prostrate, divaricately branched and thickened at the nodes, whole plant somewhat hairy. Leaves in unequal pairs, elliptic or ovate acuminate, larger 3·5 by 1·5″, thinly hairy and lineolate, tapering into a very slender petiole. Spikes ·5–2″, very glandular-hairy bracts in unequal pairs, one usually like an ordinary foliage leaf larger about 1·5″ and smaller ·5–·6″, the other or sometimes both distinctly bractiform broadly cordate ·5″ broad becoming scarious in fruit; smaller sometimes only ·2″. Flowers 3–4 together. Larger sepal leaf-like reticulate elliptic ovate ·3″. Corolla white ·3″. Capsule ·2″, 4-seeded. Seeds ·06–·08″ diam.

Only in the damper districts. Purneah (probably; it occurs in Rajshaye alongside)! Angul, in ravines! Fl. Dec.–Jan. Fr. Feb.–March.

16. BARLERIA, *L.*

Shrubs or herbs, sometimes spinescent, with opp. entire leaves and showy sessile flowers usually in spikes, rarely solitary. Bracts and bracteoles large, small or 0. Sepals 4 in decussate pairs, outer pair very much the larger, anterior sepal often 2-fid. Corolla with elongate tube, funnel-shaped upwards; lobes 5 subequal, imbricate in bud. Stamens 2 perfect, 2 rudimentary and often a rudimentary 5th; anthers of perfect stamens oblong 2-celled. Disc large, often cupular. Style long, shortly 2-fid or sub-entire. Ovules 2 in each cell. Capsule ovoid or oblong, 2- or 4-seeded below the middle. Seeds compressed, ovate with silky adpressed hairs.

I. Spinescent. Flowers yellow:—
  Bracts linear or linear-oblong, spine-tipped . . . . . 1. *prionitis.*
  Bracts sub-orbicular, closely imbricate, mucronate . . . 2. *lupulina.*
II. Unarmed. Flowers blue, rose or white:—
  A. Corolla-tube under 2″ long, funnel-shaped above:—
    1. Spikes dense secund with imbricate oblong or elliptic bracteoles . . . . . 3. *strigosa.*
    2. Spikes often few-fld., not secund. Bracteoles linear:—
      a. Corolla 2″. Outer sepals ovate, entire . . . . 4. *montana.*
      b. Corolla under 2″. Outer sepals spinulose-dentate:—
        Undershrub. Proper bracts 0. Leaves subsessile . 5. *cristata.*
        Shrub. Proper bracts linear. L. with petiole ·1–·3″ . 6. *dichotoma.*
  B. Corolla-tube 2–3″ long, slender . . . . . 7. *longiflora.*

1. **B. prionitis,** *L.* Kanta-phul, *S.*; Kanta-jati, *Beng.*; Daskerenta, *Or.*

A thorny and prickly undershrub 2–5 ft. high with elliptic, often spine-tipped leaves 1·5–4″ long and yellow flowers, one to three together in the axils and in terminal spikes with elliptic or linear-oblong spine-tipped bracts ·5–1″ long, bracteoles converted into linear-lanceolate spines (very small bristles or 0, *Clarke*). Sepals ·4″

spine-tipped (acuminate, *Clarke*), outer ell.-oblong, inner linear. Capsule ·5–·7″, with a solid beak. Seed one only, near the base of each cell.

Not common and doubtfully indigenous in the Northern and Central Areas, more frequent in the Southern Area. Monghyr Hills, *Kurz*! Gangpur, near the Brahmini River! Santal Parg., near villages! Manbhum, near villages! Puri, frequent, on rocky ground near the Chilka Lake! Sambalpur, *Griff.*! Often seen in gardens.

Shoots and young leaves pubescent and strigose. Leaves sometimes 2″ broad in vigorous plants; in dry situations these are deciduous and those on the shoots are usually oblong-lanceolate and the whole plant dwarfer and more prickly with flowers chiefly axillary (as described for *B. cuspiduta, Heyne*), lower leaves with petioles ·5–1″ or those on the secondary shoots subsessile, mature sometimes strigose on the nerves, minutely punctulate both sides, obscurely lineolate. Corolla 1–1·5″, pubescent outside (glabrous or puberulous, *Clarke*).

True thorns occur in this plant, being metamorphosed axillary shoots or inflorescences with decussate spines instead of leaves or bracts. Descriptions by different authors of the bracts, bracteoles and sepals vary widely, but these seem to depend much on the luxuriance and position in the inflorescence: a bract may bear a single flower or a small inflorescence, and sometimes a bracteole, even, will bear a fine axillary thorn.

2. **B. lupulina,** *Lindl.*

A thorny shrub 2–4 ft. high with glossy linear or lanceolate mucronate red-veined leaves 4–5″ long and yellow flowers in dense strobiliform spikes with imbricate suborbicular mucronate bracts which are usually coloured brown.

Often grown in gardens, where, if closely clipped, it forms a small hedge or edging. Fl. most of the year.

3. **B. strigosa,** *Willd.* Raila-baha, *S.*; Dasi, *Beng.*; Banmalli, *Or.*

An undershrub 2–4 ft. high with large ovate acuminate leaves 4–8″ long decurrent on the petiole and large handsome azure blue flowers 2″ long and 1·3″ wide in dense bracteolate secund spikes. Two larger sepals imbricate in a row on the upper side of the spike and the bracteoles in two lateral rows. Capsule ·75″, 4-seeded.

In moist shady places. Probably in all the forest districts. Purneah! Gaya Ghats! Singhbum! Bonai! Puri, *Lace*! Sambalpur! Kalahandi! Fl. Sept.–Nov. Fr. Feb.–May.

Branches fulvous-strigose. Leaves up to 2·5″ in width, acute or acuminate, strigose on the nerves beneath, lineolate above. Petiole 0–2″ long. Spikes 1–3″. Bracteoles often recurved ·4–·7″ lanceolate or ovate-lanceolate. Outer sepals ciliate 1–1·2″. Corolla 2-lipped, lobes ·6–·75″.

4. **B. montana,** *Nees.*

A handsome undershrub 3–4 ft. high with long erect branches from the root, ovate-lanceolate or lanceolate sub-acuminate leaves 5–6″ long below, smaller upwards, glabrous, pale-glaucous beneath, sessile or very shortly petioled. Flowers rose-coloured, axillary and in dense terminal spikes 3–8″ long with foliaceous bracts and linear bracteoles ·25–1″ long. Outer sepals ·75–1·2″, ovate entire, glabrous or nearly so. Corolla nearly 2″ long and 1·5″ broad. Capsule 1″. Seeds 4, with wavy silky yellowish hair, ·25″ diam.

Along valleys and shady sides of hills. Rare in our area. Behar, *Kurz*! Probably from the western hills. My own specimens are from the Central Provinces. Fl. Oct.–Nov. Fr. Jan.

5. **B. cristata,** *L.* Syn. B. ciliata, *Roxb.*; Jati, *Beng.*; Raila baha, *S.*; Ban-siriali (Bonai); Ban-patoli, *Or.*

An erect or diffuse undershrub 1–3 ft. high with elliptic to oblong-lanceolate leaves 2–5·5″ long and bright-rose-coloured or sometimes white flowers usually borne in great profusion, solitary or paired in the leaf axils or forming dense capitate spikes on the branchlets. Bracts foliaceous or 0. Bracteoles ·5″, linear or linear-oblanceolate shorter than or equalling the large elliptic or rhomboid shortly pectinately-toothed outer sepals, which are ·75–1″ long and strongly nerved. Corolla-tube 1·5″ long, sometimes limb sub-2-lipped, the upper lip with 4 lobes, the lower with one ·5–·75″ long. Capsule ·5–·6″, glabrous shining compressed, without a solid beak.

Hills of N. Champaran! Gaya Ghats! Santal Parg.! Very common throughout Chota Nagpur on rocky hills! Bonai, *Cooper*! Puri, on the dryer hills! Sambalpur! Kalahandi! It is often cultivated in gardens. Fl. Sept.–Nov. Fr. Oct.–Jan.

Stems sub-terete strigose. L. sub-sessile, sub-acuminate both ends, thinly strigose on the nerves, both sides sometimes also with fulvous hairs, sec. n. 4–6. Bracts (leaves) and bracteoles often deciduous in fruit, bracteoles about ·5″ or sometimes ·55–·7″ in the same plant, strigosely-hairy. Sepals scarious in ripe fruit, outer very venose, the spinulose teeth tipped by a hair, inner very small linear. Imperfect stamens 2. Seeds 2 in each cell, one at base and one near middle, sub-orbicular, ·15″ diam.

The colour of the flowers is quite different to that of the Himalayan plant, which has purple-blue corolla.

A very variable plant. The Linnean type is rather fragmentary. It has ell.-obovate or oblong leaves only 2″ long (but only the upper ones are present), hairy-pubescent beneath, acute from an obtuse tip or shortly cuspidate. Bracts long-spinose-ciliate, hairy. Fls. 1·5″, apparently blue.

Var. **albida.** Stems and leaves beneath white. L. narrow oblong or oblong-lanceolate, more hairy and more lineolate, base obtuse, petiole very short. Fls. mostly 2 to each bract. Corolla pure white glandular-pubescent.

Neterhat. Elev. 3000 ft.! Fl. Oct.

6. **B. dichotoma,** *Roxb.* ?

A shrub 4–6 ft. high with strigose and pubescent branches more distinctly quadrilateral than in the last species. Leaves oblong, tapering somewhat at base and acuminate, 3–5″ long, setulose above and strigose on the nerves beneath. Petioles ·1–·3″. Flowers bright rose-coloured like those of *B. cristata*, but axillary spikes peduncled and pairs of flowers usually on a short stalk in the axil of the leafy bracts, one or both bearing each a proper linear bract in addition to the two bracteoles. Outer sepals white between the nerves, ·7–·8″, with the spinose-teeth up to ·1″ long, dorsally with numerous stalked glands. Corolla-tube 1–1·3″ glandular-puberulous.

In gardens on the Ranchi Plateau, sometimes forming a good hedge as at Government House and very handsome in flower. Fl. Oct.

Each leaf of the spike may bear one or two flowers on a short stalk on the same inflorescence. If two flowers each has a linear bract ·5″ long and two bracteoles, or sometimes only one bears the proper bract; in a few cases it is the bracteoles which fail.

I am unable to determine satisfactorily this very handsome species, but it appears to agree well with *Roxburgh's* description of *dichotoma* except that the flowers of his plant were white. *Roxburgh's* plant has been reduced to *B. cristata*, but this is quite distinct, and, like his plant, its native country is unknown.

7. **B. longiflora,** *L.f.*

A grey velvety pubescent shrub 2–4 ft. high with small ovate leaves ·75–1·75″ long and very slender-tubed white flowers 2–3″ long, solitary axillary and in short dense but few-flowered spikes. Bracteoles ·5–1″ linear laxly patent, softly pubescent. Sepals outer ovate obtuse pubescent, scarious and very reticulate in fruit. Capsule ·7″, 4-seeded.

Puri, on dry rocky places near the Chilka Lake, *Gamble*! Fl. Nov. Fr. Jan.–Feb. Young parts tomentose. Leaves rounded at base, tomentose. Petiole ·25–·5″. Spikes mostly 1–4-fld. Corolla-lobes ·3–·5″, ovate.

17. ASYSTASIA, *Blume.*

Herbs or undershrubs, sometimes rambling, with entire leaves and opposite or alternate mod.-sized flowers in lax or dense usually secund simple or compound spikes or racemes. Bracts and bracteoles linear, usually shorter than the calyx. Sepals narrow. Corolla with a short or long tube, narrow or funnel-shaped or ventricose above, lobes 5 subequal imbricate in bud. Stamens didynamous, subequal, anthers all with 2 parallel, approximate cells, minutely spurred or with the bases only obscurely whitened. Ovary very hairy. Stigma minutely 2-fid or subcapitate. Ovules 2 in each cell. Capsule elliptic with contracted solid base. Seeds compressed rugose or tubercular, glabrous.

Rambling undershrub. Leaves elliptic to lanceolate, 2·5–4″ . . 1. *macrocarpa.*
Diffuse or rambling herb. Leaves ovate or rhomboid, 1–2″ . . 2. *gangetica.*

1. **A. macrocarpa,** *Nees.*

A tall rambling weak shrub with elliptic lanceolate or narrowly oblong leaves pubescent beneath 2·5–4″ long and secund racemes of light-purple flowers 1·5″ long. Corolla thinly pubescent, narrow part of tube only ·3″ long, then funnel-shaped. Anther-cells distinctly spurred at the base. Capsule 1·3″, pubescent, with seedless cylindric base ·6–·7″ long.

Sikkim Tarai and Jalpaiguri, to the north and east of Purneah and adjacent to it so that it will probably be found in Purneah. Fl. Dec.–Feb.

Leaves puberulous or glabrate above with 5–7 very oblique sec. n. and tapering into a petiole ·1–·3″ long. Racemes rather lax, 2–3″ (sometimes dense, *Clarke*). Calyx pubescent, ·25″.

2. **A. gangetica,** *T. Anders.* Syn. A. coromandeliana, *Nees.*

A pretty procumbent herb or sometimes subscandent among bushes with puberulous stems, ovate or rhomboid-oblong leaves 1–2″ long and blue, purple or pink flowers 1–1·5″ long and 1″ diam. (sometimes with a yellow or greenish tube), in terminal racemes 2–5″ long with very short pedicels. Capsule 1–1·2″ long pubescent with seedless portion below ·3–·5″ and shortly beaked above the 4 seeds which are corrugated at the edges and tubercled on the faces.

Climbing in *Pandanus* hedges at the south end of the Chilka Lake, *Alcock*! It is also common near Calcutta! so is likely to be found in other parts of Orissa. Fl. Nov.–Dec. and again from end of March to May.

Leaves slightly hairy with slender petiole ·5″ long. Calyx ·2″, hairy. Narrow tubular portion of corolla only ·3″ then ventricose, puberulous, lower lobes sometimes more deeply coloured than the posterior.

18. CROSSANDRA, *Salisb.*

Undershrubs with entire or undulate subdentate leaves and orange or yellow mod.-sized flowers in linear-oblong spikes with imbricate bracts. Bracteoles linear. Sepals 5 ovate, 2 inner smaller. Corolla with narrow tube curved at the mouth, limb with 5 subequal elliptic lobes imbricate in bud. Stamens didynamous, all with 1-celled anthers, connective mucronate. Stigma minutely 2-lobed. Ovules 2 in each cell. Capsule oblong. Seeds 4, orbicular compressed, adpressedly scaly, the scales consisting of connate hairs, the tips of which become free when moistened.

1. **C. undulæfolia,** *Salisb.* Syn. C. infundibuliformis, *Nees.*

A small shrub 1–3 ft. high with ovate or lanceolate undulate leaves 3–4″ long, tapering both ends, and pubescent spikes 1–4″ long of orange or orange-scarlet flowers. Bracts ·5″ elliptic acute. Sepals imbricate, outer ·3″. Corolla-tube slender, ·75″, lobes ·5″.

Common in gardens and sometimes self-seeding. Native of India. Fl. r.s.

19. ERANTHEMUM, *L.*

Glabrous shrubs or undershrubs with entire rarely serrate leaves and rather small or mod.-sized flowers situated 1–3 together in the axils of opposite bracts of terminal spikes. Bracts and bracteoles small and narrow. Calyx 5-fid or -partite, segments narrow. Corolla-tube linear, rarely ventricose at the throat, lobes 5, sub-equal. Stamens 2 with perfect 2-celled anthers, cells equal, parallel; 2 staminodes usually present. Stigma entire or minutely 2-lobed. Ovules 2 in each cell. Capsule and seeds as in *Asystasia.*

The cultivated species have often handsome coloured or variegated leaves.

1. **E. palatiferum,** *Nees.*

An undershrub about 3 ft. high, with stems pubescent above. Leaves broadly lanceolate, acuminate, up to 8″ long, tapering at base, not or obscurely lineolate, sec. n. 8–10. Petiole ·3″. Flowers purple, with often a yellowish spot on mid-lobe of lower lip, secund on branched pubescent racemes often 12″ long. Calyx ·2″ with linear pubescent sepals. Corolla-tube 1·25–1·3″, limb 1–1·25″ diam., obscurely 2-lipped. Capsule ·9″, pubescent.

Comes close to our area (Purneah) in the forests of Terai. Fl. April.

E. bicolor, a species very common in gardens, has broadly lanceolate leaves with a slender petiole up to 1″. Corolla white with purple spots on lower lip, tube 1·25″, limb 1″ diam. Native of Malay Archipelago.

20. NEURACANTHUS, *Nees.*

Perennial herbs or undershrubs with entire leaves and small blue flowers in axillary or terminal elongate strobilate or capitate spikes with often strongly-nerved, sometimes 4-ranked elliptic or ovate bracts. Bracteoles 0 or minute. Calyx sub-2-lipped, posterior lip 3-toothed, anterior 2-toothed or -partite. Corolla with a short tube, then suddenly ventricose or funnel-shaped, limb plicate 2-lipped with 5 sub-similar segments or obscurely lobed. Stamens didynamous, anterior anthers 2-lobed, posterior 1-lobed, the other lobe rudimen-

tary or 0, lobes ovoid distinct sometimes hairy. Style 2-branched at the apex, one branch obsolete. Ovules 2 in each cell. Capsule oblong, glabrous. Seeds 4, ovate, much compressed, densely silky.

1. N. tetragonostachyus, *Nees.*

Scarcely suffruticose, with a perennial creeping rootstock, subterete usually inclined or nodding strict stems 1–2·5 ft. high with two lines of hairs, elliptic membranous leaves attenuate both ends and bright blue flowers ·3″ long in 4-gonous spikes which are solitary erect at the nodes and terminal, 1–1·5″ long. Bracts elliptic-ovate or elliptic ·3–·35″ long, concave, with 5 very strong raised nerves meeting at the aristulate tip.

On trap in the Rajmahal Hills (Sant. Parg.)! The only record from India, all other specimens being Burmese. Fl. Jan.–Feb.

L. acuminate, hispid-pubescent on the 5–6 sec. n. beneath and more shortly so between, base attenuate into a very short petiole or petiole 0. Spikes sessile, linear-oblong, about ·3″ broad. Bracts pale, thinly pilose, ciliate and muriculate on the edges and principal nerves. Calyx ·25″, minutely tubercled and densely white-villous, segments linear-lanceolate. Corolla-tube conical at base, limb 2-lipped hairy, ·25″ diam., upper lip darker-blue-veined. Capsule ·25″ oblong compressed with a short solid beak or very acute.

21. LEPIDAGATHIS, *Willd.*

Herbs or undershrubs with entire or crenate or serrate leaves and small sessile flowers mostly in dense bracteate usually secund often fascicled spikes or heads; sometimes spikes aggregated near the base of the stem. Bracts usually exceeding the calyx, bracteoles narrower than the bracts. Calyx with unequal segments, the two anterior more or less connate into one. Corolla tubular or tube sometimes sub-globose at the base, then suddenly constricted, always again suddenly ventricose about the middle and limb 2-lipped, upper lip notched or 2-lobed, lower spreading 3-fid, usually spotted. Stamens didynamous, all 2-celled or one pair 1-celled,* one cell often attached higher up than the other, cells often bearded. Stigma capitellate, minutely 2-fid or entire. Ovules 2 in each cell. Capsule elongate, conoid or oblong. Seeds 2–4 compressed, ovate-oblong or orbicular hairy.

A. Flowers chiefly aggregated in masses at the base of the stem or on rootstock:—
  Bracts lanceolate spinescent, not squarrose. Sepals spinescent. Spikes in dense cushions . . . . . 1. *Hamiltoniana.*
  Bracts ovate or obovate, suddenly spinose-cuspidate with the cusp subsquarrose. Sepals not spinescent. Spikes more or less distinct . . . . . 2 *trinervis.*
B. Flowers in axillary solitary or clustered spikes:—
  1. Capsule 2-seeded, thin. Spikes clustered, often some also radical. Leaves linear . . . . . 2. *trinervis.*
  2. Capsule 4-seeded, oblong:—
    a. Leaves entire or undulate:—
      One pair of anthers 1-celled. One sepal much broader than the other 4 . . . . . 3. *purpuricaulis.*
      All anthers 2-celled. One sepal only slightly broader . 4. *hyalina.*
    b. Leaves crenate or crenate-serrate . . . . . 5. *fasciculata.*

* The character of one pair of anthers sometimes 1-celled is not found in other works, which nevertheless include *L. purpuricaulis* in the genus, in which it invariably occurs according to my observations. This brings the genus very close to *Neuracanthus*, the only other character left to distinguish it being the presence of bracteoles. In the very congested inflorescences of the *Hamiltoniana* section even these seem to fail in some flowers, but the corolla is much more decidedly 2-lipped than in *Neuracanthus*.

1. L. Hamiltoniana, *Wall.* Agni-Khair, *M.*

A herb with a perennial rootstock, erect or several diffuse 4-angled stems 6–18″ high and linear leaves 2–4″, or attaining 6″ by ·4″, acute, subsessile, nearly glabrous except the minutely scabrid-ciliate margins. Flowers ·5″ long in very congested spikes forming prickly cushions at the base of the plant. Bracts, bracteoles and sepals all lanceolate acuminate and ending in a spine. Corolla ·2″ to the ventricose part, nerved, lower lip nearly ·5″ diam. with the midlobe somewhat shovel-shaped.

Common on dry slopes, banks, etc. Shahabad, *J.D.H.*! Bhagulpur, *Ham.*; Chota Nagpur, common! Angul, *Chatterjee*! Sambalpur (under *L. cristata*), *Griff.*! Probably in all districts of the Northern and Southern Areas. Fl. Dec.–Feb.

Angles of stem usually much raised, sub-alate, nodes sometimes pilose. Leaves with strong midrib and 4–7 very oblique sec. n. which run nearly parallel to margin but except towards tip scarcely form an intramarginal nerve (as in *trinervis*). Spikes 1-sided, their bases sheathed by ovate or lanceolate acuminate-spinescent bracts. Bracteoles ·37″, membranous below, ciliate upwards; sometimes a bracteole bears a flower to which it becomes a bract and this flower is ebracteolate. Longer sepal about ·37″, ell.-oblong or -lanceolate acuminate-spinous, villous. Corolla silkily-hairy. Capsule ·26″, narrowly conical or lanceolar in outline, glabrous, acute, somewhat compressed, with the wider (compressed) sides membranous, the other sides firm; enclosed in the somewhat enlarged fruiting sepals.

Used in Chota Nagpur for the capture of evil spirits.—*Rec. S. L. Thompson.*

2. L. trinervis, *Nees.*

A herb with numerous tough stems 6–15″ high from a very woody rootstock. Leaves sessile linear, or when small often oblong or elliptic, ·5–2·3″ long. Flowers white in short ovoid often 1-sided spikes ·3–·5″ long, axillary and often aggregated at the base of the plant, with ovate or obovate or ovate-oblong spinose-cuspidate bracts ·5–·75″, the subsquarrose cusp as long or nearly as long as the blade. Capsule ·25″.

Shahabad; Rhotas-ghar and summit of Kymore hills, *J.D.H.*! Chota Nagpur, *teste Clarke*, but the specimens referred to this in the *Cal. Herb.* are possibly *L. Hamiltoniana* and I have seen no others from Chota Nagpur. The locality in *Wood's List* is probably also on the strength of these specimens. Pathra Forest, Gaya!

Although sometimes aggregated at the base of the plant the individual spikes are distinct, not merged uniformly into a cushion as in *Hamiltoniana*, and there are nearly always additional spikes on the branches. Leaves 3-nerved, much more distinctly so than in *L. Hamiltoniana*; those in the Gaya plant are *very distinctly* 3-nerved but are up to 4″ long, and as the plant was not in flower its determination is somewhat doubtful, sec. n. very inconspicuous, horizontal between the midrib and the lateral nerves. Bracteoles linear-lanceolate, membranous. Calyx segments not spinose. Corolla ·3″.

3. L. purpuricaulis, *Nees.*

A diffuse branched suffruticose herb with stems 2–3 ft. high, sometimes rooting at the lower nodes. Leaves in each pair very unequal, lanceolate or ovate-lanceolate, acuminate, 2·5–4″ long. Flowers in dense glandular spikes ·5–·7″ long congested on small lateral branches (peduncles) with oblong-lanceolate ·3″-long acuminate strongly-nerved gland-hairy bracts. Corolla ·3–·4″ tubular below then somewhat ventricose, upper lip rounded notched, lower lip spreading deeply 3-fid, longer, white spotted purple, hairy outside. Stamens

didynamous, upper pair shorter with 1-celled anthers, *the second cell replaced by a knob.*

Singbhum, Saranda forests on shady banks! Parasnath, *Thoms.* and *Anders.*! Fl. Feb.

Branches flexuous 4-angled and swollen below the nodes and with puberulous stipular lines. Smaller leaf in each pair often less than half the larger, both attenuate at base, scarcely petioled or petiole winged, pale beneath, membranous, glabrous or minutely ciliolate or young hairy, deciduous on the older branches but with tufts of smaller leaves and glandular spikes at the nodes. Bracts with subaristate tips, bracteoles linear, ·35″. Calyx sub-2-lipped, densely glandular hairy, sepals very unequal, dorsal prominently 7-8-nerved, two anterior 3–4-nerved oblong-lanceolate, innermost (lateral) linear 1–3-nerved, all subaristately acuminate. Stigma simple.

4. **L. hyalina,** *Nees.*

A much-branched herb 1–2 ft. high with root of fleshy fibres, stems subterete with 4–2 raised green lines decurrent from the base of each leaf. Leaves variable in shape, oblong, ovate or linear, 2·5″ in some forms to 7″ long in others, always decurrent on the petiole, rather strongly nerved. Spikes numerous dense, 2–10 together, fascicled secund, on very short axillary peduncles and forming dense terminal heads, ·5–1·5″ long. Flowers ·3″ long distinctly 2-lipped, white with mottled-brown palate or upper lip brown. Bracts very dense 4-farious imbricate, ·3–·4″, ovate-oblong or lanceolate acuminate with a strong midrib excurrent as an awn or point, bracteoles similar or narrower. Outer sepals nearly as long, oblong sub-aristate, strongly 3-nerved, margins long ciliate and glandular, inner narrow. Capsule ·22–·25″ oblong with a short beak, sides parallel to septum rather thin.

Usually in damp places, among rocks in the Sal forests, or on banks along nalas and firelines. Throughout Chota Nagpur! Angul, *Chattarjee*! Sambalpur, *Griff.*! As it also occurs in the Sikkim Tarai and Duars it will probably be found throughout our area. Fl., Fr. Dec.–April. Perennial.

Stems often reddish. Branches more or less pubescent, especially near nodes, with the 4 green lines sometimes much raised. Leaves often light-coloured or yellowish along centre and main nerves, varying from ·25-·3″ broad to 2·25″ broad; margins entire or undulate, slightly pubescent on nerves beneath and with small scattered hairs above or hairy both sides or (in Angul specimen) glabrous above but densely shortly lineolate, beneath often shiny; sec. n. 7–9. Petiole ·1″ (in uppermost leaves) to 1·5″ Dorsal bracts of spikes barren, all with marginal nerve and long cilia and glandular. Cor. ·3–·35″ long, tubular below, suddenly ventricose, upper lip emarginate or 2-lobed, concave; lower patent. Beak of capsule puberulous. Seeds ·04″.

5. **L. fasciculata,** *Nees.* Serendri-dumbu, Bile-mata-a:, *K.*

A highly aromatic viscous hairy herb 1–2 ft. high, much branched from the creeping rootstock, with crenate or serrate ovate acuminate leaves much decurrent on the petiole and small white-lipped flowers in numerous subcapitate spikes rarely exceeding ·5″ in length.

Among rocks in the Sal forests and in grass near nalas. Singbhum, common! Sambalpur, *Griff.*! Kalahandi! Fl., Fr. Jan.–April.

Stems hairy and glandular with 4 raised green lines. Lower leaves attaining 5″ by 2″ or sometimes 6″ by 2″ including the short petiole on which the blade is decurrent nearly to its base, sometimes quite coarsely toothed, at other times shallowly crenate, hairy or glabrescent both sides; sec. n. 7–9 curved strong beneath with sub-scalariform tertiaries. Spikes usually very many and congested at the ends of the branches, very short with oblong or elliptic 3-nerved hairy bracts ·25″ long, acute, but not at all aristulate, bracteoles narrower. Sepals hairy, upper broad oblong or lanceolate ·2–·22″, 3-nerved acute, anterior also 3-nerved, linear-

oblong, lateral almost setaceous. Corolla ·25-·3″, tubular or subglobose for ·1″ then constricted and suddenly ventricose, upper lip shortly 2-lobed. Anther-cells wide apart, one a little above the other, slightly hairy, mucronate at the base. Capsule ·2″ long or very slightly exceeding the calyx, compressed with broader sides thin pubescent and grooved on the narrower sides and short beak. Seeds 2–4 light brown, yellow-hairy when wetted. If the capsules, when ripe, are wetted they burst violently, scattering the hygroscopically-hairy seeds in all directions.

22. APHELANDRA, *R. Br.*

Shrubs or tall herbs with entire or toothed leaves and showy yellow orange or scarlet flowers in terminal simple or branched conspicuously bracteate spikes. Bracts imbricate often coloured, entire, ciliate or spinose. Bracteoles small. Calyx with posterior segment usually broadest, others equal or somewhat unequal in width. Corolla with long straight or somewhat curved tube cylindrical or somewhat widened upwards, 2-lipped, upper lip entire or more or less 2-fid, lower lip with the mid-lobe spreading and recurved, the lateral lobes sometimes obsolete or small at the base or sides of the mid-lobe, or as large and spreading. Stamens 4 inserted near the base of tube, subequal, anthers exserted, dimidiate, 1-celled, sometimes cohering by their bearded tips when young, ultimately often muticous, pollen oblong subterete with a fine line (or fissure ?) on one side. Stigma oblique or truncate, or minutely 2-lobed. Ovules 2 in each cell. Capsule oblong, often shortly contracted at base.

A tropical American genus of which several handsome flowering shrubs or undershrubs are now common in Indian gardens.

1. **A. pectinata,** *Willd.*

A shrub 3–4 ft. with coarse rusty pubescence on twigs, obovate or oblanceolate entire leaves 3–5″ tapering to a very short petiole and with very prominent sec. n. beneath which are depressed above. Flowers narrow, scarlet, in sessile elongate spikes from the uppermost leaf axils (thus appearing terminal). Bracts usually spinulose-serrate towards the apex.

In gardens. Fl., Fr. Aug.–Oct.

L. acute or obtuse with about 12 sec. n. Spikes 2-5″ long with opp. decussate oblong acuminate silkily hairy bracts ·5″ long. Fls. 1·5″. Bracteoles ·3″, narrowly lanceolate silky. Sepals ·35″, similar but rather broader, imbricate. Cor. hairy, tube constricted above ovary, lower lip entire ·5″, ultimately revolute, linear-oblong; upper lip erect straight or recurved with 2 short acute lobes. Fil. hairy below, anther boat-shaped dorsifixed.

2. **A. tetragona,** *Nees.* Syn. A. cristata, *Lindl.*, non *R. Br.*

A shrub with large elliptic leaves acute or acuminate both ends or ovate and cuneate on the petiole. Flowers scarlet in clustered spikes 4–8″ long, the rhachis and base of calyx densely woolly. Bracts velvety-pubescent quite entire ovate acute. Corolla 1·5–2″, nearly glabrous, upper lip 2-fid, mid-lobe of the lower lip lanceolate, the lateral very short.

In gardens. Native of Central America.

3. **A. cristata,** *R. Br.*

A shrub about 3 ft. high with lanceolate leaves 7–8″ long and numerous large orange-scarlet flowers in panicled spikes. It lacks the dense tomentum of the last.

Other species are sometimes found in gardens.

23. RUNGIA, *Nees.*

Herbs, rarely shrubs, with entire leaves and small usually blue sometimes white flowers in dense secund bracteate spikes with the bracts 2- or 4-ranked, usually with scarious margins, dorsal sometimes barren, bracteoles similar to the bracts or narrow. Calyx small with 5 linear-lanceolate segments. Corolla with short tube; upper lip emarginate, shorter than the 3-lobed lower lip. Stamens 2, anther cells 2, subequal parallel or usually superposed with the lower cell muticous or white-tailed. Stigma minutely 2-fid. Ovules 2 in each cell. Capsule ovoid or oblong, placentæ with the retinacula rising elastically from the base scattering the seeds. Seeds normally 4, compressed, orbicular, glabrous, minutely or strongly concentrically verrucose.

Flowers under ·15″ long. Spikes 1-sided, bracts ·12–·17″ . . . 1. *parviflora.*
Flowers ·3″. Spikes with 4-farious bracts ·2″ long, less 1-sided . . 2. *repens.*

1. **R. parviflora,** *Nees.* Hasa-arak', *S.*

A diffuse or erect herb with stems 6″–2 ft. long, terete below, faintly 4-angled above, with recurved pubescence at the angles. Leaves from linear or narrowly lanceolate to narrowly elliptic, 1–2·5″ long, narrowed both ends, nearly glabrous except on the nerves, very lineolate. Flowers very small, blue or purple, in clustered secund spikes ·25–·6″ long with two rows of imbricate barren ovate to lanceolate bracts and two ventral rows of suborbicular or obovate flowering bracts ·12″ diam. including the wide scarious margins. Capsule ·08″ compressed with the flattened broader faces thinly membranous, the lateral narrow faces coriaceous and elastically spreading from the apex and falling off at the same time as the placentæ rise from the base.

A common weed throughout the province, erect in open grassy places in the forests or prostrate in pastures. Fl., Fr. most of the year, chiefly c.s.

All specimens from our area appear to belong to the variety **pectinata,** *Clarke* (*R. pectinata, Nees*), in which the flowering bracts are hairy and the barren bracts mucronate or cuspidate.

L. sometimes slightly pubescent beneath, sec. n. very oblique, 4–7. Petiole ·2–·3″. Dorsal bracts ·17″, often sub-aristate with white or reddish scarious margins, 1–3-nerved; anterior and bracteoles with the membranous margin often with a sinus at the tip and the green centre mucronate or sub-aristate. Calyx ·1″, segments silky. Corolla ·12″, upper lip usually colourless simple acute, shorter than the spreading purple or blue obtusely 3-lobed lower lip.

2. **R. repens,** *Nees.*

A procumbent branched herb with strigillose stems 6–12″ and rather small lanceolate leaves ·3–1·5″ long. Flowers ·3″ blue, or pale rose (*Ritchie*), in spikes 1–2·5″ long, conspicuous from the closely regularly imbricated 4-farious large broadly-elliptic scarious-bordered bracts which are ·2″ long. Capsule ·25–·3″, minutely thinly hairy (*Clarke*).

Said to occur throughout India, *Clarke*; but the only specimens seen from our area are from the Rajmahal Hills. Rahmahal, *Wallich*! Sahibganj, *Kurz*! Fl. Dec.–Jan.

Branches sometimes rooting at the nodes. Bracts sometimes hairy, the green part lanceolate in shape apiculate or aristate, sometimes hairy. Filaments white, anthers blue.

24. JUSTICIA, *L.*

Shrubs or usually herbs with entire leaves and sessile or subsessile small rarely mod.-sized flowers usually in spikes with conspicuous bracts and small bracteoles, rarely axillary or in dense cymes without a terminal spike (and not in our area). Bracteoles sometimes 0. Calyx 5- or 4-partite, segments narrow. Corolla 2-lipped with tube equalling or shorter than the limb; upper lip 2-lobed or subentire, lower 3-lobed, anterior lobe outermost in bud. Stamens 2, filaments often dilated, hairy near the base; anthers 2-celled, cells round or oblong, more or less discrete, lower with a white spur. Style filiform, stigma 2-fid. Ovules 2 in each cell. Capsule oval or ellipsoid, sometimes with a long cylindrical seedless base. Seeds ovoid more or less compressed, tubercular, scaly or glochidiate-hispid, not with hygroscopic hairs.

A. Calyx-segments 5, equal or nearly so:—
  1. Bracts broad, ovate or obovate:—
    Suffruticose, bracts ovate white, green-nerved . . 1. *betonica.*
    Herb, bracts green, obovate, often patent . . . 2. *glauca.*
  2. Bracts narrow. Undershrub, bracts linear . . . 3. *gendarussa.*

B. Calyx-segments 4, very rarely a minute fifth present:—
  1. Glabrous or nearly so. Bracts and sepals linear obtuse:—
    Erect or ascending. Leaves linear or lanceolate, subacute or subobtuse . . . . . 4. *quinqueangularis.*
    Diffuse. Leaves broadly elliptic or obovate, rounded . 5. *peploides.*
  2. More or less hairy. Bracts and sepals usually lanceolate, very acute:—
    Spikes very slender, ·1–·15″ wide, hairs short . . 6. *diffusa.*
    Spikes stout, ·4–·75″ broad, often hirsute or hairy . . 7. *simplex.*

1. **J. betonica,** *L.* Had-pat, *K.*

Erect, suffruticose, usually with many striate stems 2–4 ft. high from a perennial rootstock, ovate-lanceolate entire or somewhat crenate-dentate leaves attaining 4·5″ by 1·75″, smaller upwards, mostly acuminate both ends. Flowers small white rose-spotted in mostly terminal 1–3-nate spikes conspicuous from the closely imbricate white green-veined ovate or narrowly ovate acute or mucronate bracts ·5–·6″ long and bracteoles resembling the bracts. Capsule ·3–·5″, stout clavate pubescent.

Mostly in rocky forests, especially towards ravines. Singbhum, common! Hazaribagh! Palamau! Puri! Angul! Fl., Fr. Nov.–March.

Stems puberulous to subtomentose, swollen above the nodes, terete. Leaves glabrous or pubescent both sides, sec. n. 6–8 fine raised. Petiole of lower larger leaves ·5–·75″, of uppermost 0. Spikes often panicled 2–6″ long, bracts with the sec. n. meeting in an intramarginal one. Calyx ·25″, sepals subulate or linear-lanceolate, pubescent. Corolla hairy, upper lip ·2″, lower ·4″ broad. Anthers long-spurred (in Angul and in Puri specimens). Seeds 2–4 with a corrugated or rugose testa.

The plant is used as a cure for diarrhœa.

Var. *a,* **villosa,** *Clarke.*

Stems and leaves very hairy or tomentose but scarcely worthy of varietal rank. *Clarke* says "flowers salmon-coloured," but they only have pink or buff markings where I have seen them.

Singbhum, frequent! Parasnath!

Var. *β*, **ramosisisma,** *Clarke.*

Stems diffuse decumbent, bracts rather narrower.

Palamau, *Gamble*! Puri!

2. **J. glauca,** *Rottler.* Syn. J. orixensis, *Roxb.*

An erect or somewhat diffuse herb 1–2 ft. high with tough purple stems and pubescent branches with much swollen bases. Leaves ovate or elliptic 1–3″, pubescent or puberulous on the nerves beneath. Spikes with pubescent rhachis 2–4″ long, well characterised by the foliaceous ·25″ long bracts which are rounded-obovate but suddenly contracted into a semi-petiolar base, somewhat lax and patent, not imbricate except in the young spikes. Capsule ·25″ clavate.

Puri, Haripur forest! Fl., Fr. Nov.–Dec.

Cauline leaves usually acute both ends, those on the branches often smaller and rounded, lineolate above; sec. n. 4–5. Petiole in larger leaves ·3–·4″. Bracts ciliate when young. Calyx ·15″ with linear acuminate sepals ·15″ long. Cor. ·3″, tubular portion included in the calyx, upper lip oblong, slightly notched, white, purple spotted, lower broad with 3 obtuse lobes, palate spotted purple and transversely plicate or rugose. Filaments flattened. Seeds 4 brown-black, closely covered with large very pointed tubercles. Retinacula very long.

3. **J. gendarussa,** *L. f.* Syn. Gendarussa vulgaris, *Nees*; Jagatmadan, *Beng.*

An undershrub 2–4 ft. high, the subterete branches with sometimes raised lines or a line of pubescence. Leaves lanceolate or linear-lanceolate 3–5″ long, glabrous except when very young. Flowers white, spotted purple within, in interrupted spikes 2–5″ long from the uppermost leaf axils and often forming a terminal panicle. Bracts linear about ·12″ only. Calyx ·15–·2″ with nearly glabrous linear segments. Corolla ·5″. Capsule ·5″, clavate, glabrous.

Prain says "in all the provinces," but it is nowhere wild in our area, the nearest district where it is undoubtedly wild being at the foot of the Himalayas in Jalpaiguri in stony forests under shade! It is, however, very frequently cultivated as an edging to walks and flower-beds and kept pruned. Fl. April–May. My specimens show no fruit, and according to *Clarke* the seed is very rare in cultivation.

Lines of pubescence on the branches alternating in position between the nodes. L. entire or undulate. Spikes with puberulous rhachis. Flowers mostly in clusters on the rhachis. Lower anther-cell orbicular, spurred.

4. **J. quinqueangularis,** *Koen.*

Erect, or ascending from a geniculate base, with 5-sided stems 12–20″, internodes long nearly glabrous. Leaves in distant pairs linear or linear-lanceolate subacute or subobtuse ·5–2·5″ long, minutely lineolate above. Flowers ·32″ long, white with a few pink markings, in terminal, rather lax (internodes visible) spikes 1–4″ long with linear glabrous scarious-margined bracts and bracteoles about ·17″ long. Calyx ·15–·2″ long in flower, sepals linear-oblong with green centre only, obtuse. Capsule ·25–·3″, stout.

Santal Par. (Rajmahal), *Wall.*! Singbhum! Ranchi, common! Manbhum, *Camp.*! Burdwan, *Clarke*! Fl., Fr. Sept.–Nov.

Leaves sometimes ·3″ broad. Spikes often long-peduncled. Fruiting sepals sometimes ·25–·3″ long. Lower lip of corolla ·17″ broad. Seeds slightly concentrically tubercular-rugose, *Clarke.*

5. **J. peploides,** *T. Anders.* Syn. J. quinqueangularis, var. peploides, *Clarke*; Mathom-ara, *S.*

Very diffusely branched from near the base with numerous spreading 4–5-sided branches 3–6″ or sometimes 15″ long. Leaves broadly elliptic or broadly oblong with rounded tip and base suddenly contracted, rarely oblanceolate, ·6–1·3″ long and up to ·75″ broad. Petiole slender ·2–·3″ long. Spikes shorter than in last and often subovate when young, but attaining 1·8″ with usually the lowest pair or pairs of flowers axillary. Bracts linear or linear-spathulate with rounded tips and scarious margins, bracteoles ·17–·18″ long, similar but more slender, sepals as in last, sometimes only ·12″ in flower and subobtuse. Capsule ·25–·3″ elliptic-oblong mucronate glabrous.

Purneah, *Kurz*! Santal Par., *Kurz*! Monghyr, *Cal. Herb.*! Plains of Behar, *J.D.H.*! Fl., Fr. Aug.–Oct.

Clarke is probably right in considering this only a variety of the last, but owing to the habit and different-shaped leaves it is easily recognised.

6. **J. diffusa,** *Willd.*

A herb 6–15″ with more or less 4-angled and grooved stems strigose with reflex hairs, elliptic, narrowly-ell., or ovate-lanceolate leaves not exceeding 2·5″ by ·8″ (often much smaller), very lineolate both sides, and very slender spikes 2–4″ long and ·1–·15″ wide (in flower), of small pinkish or white flowers, the bracts towards base somewhat distant and shorter than the sepals, hispidly-hairy. Bracts, bracteoles and sepals membranous with green midrib. Capsule glabrous or hairy oblong ·18″–·2″ with very short solid base. In fruit the spikes are somewhat wider owing to the opening of the capsules and spreading of the bracts and sepals, but they are always more slender, less dense, and with the hairs on the inflorescence less spreading and shorter than in *J. simplex.*

Monghyr, *Ham.*, *Kurz*! Rajmahal Hills, *Kurz*! Singbhum, frequent! Hazaribagh, *Clarke*! Ranchi Ghats, *Gamble*, *Wood*! Sambalpur, *Griff.*! Ganjam (just outside our area), *Cal. Herb.*! Probably therefore throughout the province. Fl., Fr. June–Jan.

Leaves glabrous or with scattered hairs along the nerves, or sub-hispidly hairy beneath, sec. n. 6-8. Petiole ·25–·3″. Bracts linear-lanceolate or linear or sometimes (in same spike) ovate with a long acumen, sometimes only one-third to one-half as long as the sepals, rarely three-fourths, ciliate and sometimes also pubescent. Bracteoles subsimilar to bract. Calyx ·2–·25″ long, sepals 4 linear or shorter in upper part of spike and relatively shorter to bracts. Corolla ·25–·3″, white, spotted pink, hairy.

Var. **orbiculata,** *Clarke.* Syn. J. orbiculata, *Wall.*

Leaves broadly ovate ·3–1″, petioled, hairy, especially beneath.

Parasnath, *Cal. Herb.*! Manbhum, *Thoms.*! Fl. Nov.

Var. **Yahlii,** *Clarke.*

L. narrowly lanceolate or linear, bracts lanceolate white-margined, sepals lanceolate subacute with minutely scabrous tips.

Chota Nagpur, common, *Clarke.*

7. **J. simplex,** *Don.*

A herb of rather lax but erect growth 8″ to 2·5 ft. high with angular and grooved hairy stems swollen above the nodes, elliptic or elliptic-

oblong (ovate, *Clarke*), markedly lineolate and sometimes strigose leaves 1–2·5″ or 3″ long by ·4–·75″ broad, and very small rose-coloured flowers in axillary and terminal dense sessile hairy spikes ·75–3″ long and ·3″ diam. Bracts 4-ranked and bracteoles and 4 sepals all membranous with green centres or green midribs and hirsutely hairy or ciliate. Capsule ell.-oblong ·16″ with solid base and hairy tip.

Frequent in valleys in Chota Nagpur. Singbhum! Ranchi, *Clarke*! Hazaribagh, on Parasnath! Palamau, Neterhat, 3000 ft.! Fl., Fr. Oct.–Jan.

Stems quadrilateral with the two of the opposite angles with a groove so that, according to the width of the groove and the nature of ridge on either side of it, the stem is variously described as 4-angular or 6-angular, hairs on lower parts reflexed, more spreading above and at the nodes. Leaves slightly tapering both ends to a subacute or sub-obtuse tip, hairs few on the nerves both sides and sometimes shortly ciliate. Sec. n. 5. Petiole ·2–·25″. Bracts narrowly obovate or lanceolate or oblanceolate, ·18–·22″, strongly ciliate. Bracteoles as long linear or oblong-linear hispidly hairy. Sepals 4, more narrowly linear, ·16–·18″, hirsute or hairy. Corolla ·2″, hairy, upper lip concave below, subquadrate entire or notched above, lower lip with 3 rounded lobes. Anthers sometimes with the lower cell reduced to its spur. Seeds not much compressed, suborbicular-cordate, brown-black, granulate or concentrically rugose.

Var. **serpyllifolia**, *Benth.*

About 6–8″ only closely branched with elliptic to suborbicular leaves ·5–·7″ and spikes about 1″ long and ·17″ broad. Bracts ·08″ long, fulvous-hirsute.

Manbhum, *Clarke*! Parasnath, *Clarke*!

25. ADHATODA, *Nees.*

Shrubs with entire leaves, and large flowers subsessile in the axils of opposite bracts of axillary and terminal, sometimes thyrsiform, spikes. Bracts larger than the calyx and bracteoles sub-similar, not membranous. Calyx-lobes 5 imbricate or 2 lowest subconnate. Corolla 2-lipped, tube short, upper lip galeate, subentire, lower spreading 3-lobed. Stamens 2, near top of corolla-tube, anthers 2-celled, cells minutely apiculate at base. Stigma entire. Ovules 2 in each cell. Capsule clavate-oblong with a long solid base. Seeds 1–2 suborbicular, compressed, rugose.

1. **A. vasica,** *Nees.* Vasaka, *Beng.*; Arusha, *H.*

A bushy shrub 3–8 ft. high with large minutely pubescent elliptic or ell.-lanceolate acuminate leaves 5–8″ long with a fœtid smell, and large white flowers 1·3″ long. Spikes 1–3″ often several together at the ends of the branchlets with ovate, elliptic or obovate bracts ·75″ long and bracteoles ·5″. Calyx ·3–·5″ with equal lanceolate lobes. Cor.-tube with a short basal portion then inflated; throat transversely barred with rose or yellow; lips about ·75″ long. Filaments hairy at base only. Capsule ·75″, pubescent.

Nowhere certainly wild in our province; possibly so in northern Purneah! Common in villages or near villages, Balasore! Angul! Sambalpur! Often seen in gardens in all other districts. Fl. Feb.–March and also at the end of the r.s.

Said to be a good insecticide. "Leaves and root expectorant and antispasmodic, and considered serviceable in phthisis." *Dutt.*

Jacobinia Gheisbreghtiana, *Benth. & Hooker,* is a handsome undershrub with scarlet flowers in terminal panicles. Gardens.

Fittonia spp. are pretty little low trailing plants with beautifully coloured veined leaves and rather inconspicuous flowers in bracteate spikes. They are natives of Peru and commonly seen in grass greenhouses.

26. ECBOLIUM, *Kurz.*

Shrub or undershrub with entire leaves and blue flowers in terminal dense spikes with large imbricate bracts and small narrow bracteoles. Calyx sub-5-partite, segments equal or rather unequal, narrow. Corolla with long almost filiform tube and 2-lipped limb, upper lip narrow slightly 2-cleft, lower 3-lobed. Stamens 2 inserted near top of tube, anther-cells 2 oblong parallel approximate, muticous. Stigma shortly 2-fid. Ovules 2 in each cell. Capsule ovoid compressed with long barren base. Seeds 4–2, large, compressed, orbicular, tubercular-scabrous.

1. **E. Linneanum,** *Kurz.* Var. dentata, *Clarke.*

An undershrub 2–4 ft. with tough green branches, lanceolate or ovate-lanceolate leaves, acuminate both ends, 4–9·5″ long, and steel-blue or greenish-blue rarely white flowers, only opening one or two at a time, in dense spikes 1–3″ long. Corolla with a very slender tube 1″ long. Capsule ·7″ sub-spathulate with an ovate upper portion very acute or cuspidate compressed at right angles to the long lower barren base.

Moist shady places. Hills of Puri! Fl., Fr. Sept.–April.

L. tapering at base into a short winged petiole, tip sometimes caudate, pale beneath, puberulous or pubescent on the 5–6 sec. n.; tertiary n. faint. Bracts herbaceous, pale-green, ovate-elliptic, ·75″ long, dentate or denticulate and with a fine short cusp, somewhat glandular-hairy. Calyx segments ·15″ long, linear-subulate. Cor. softly hairy, lower lip wrapping round the very slender upper lip in bud. Anthers purple. Seed usually 1 in each cell, with lines of strong papillæ.

27. GRAPTOPHYLLUM, *Nees.*

Glabrous shrubs with entire or spinous-toothed, usually variegated leaves and red pedicelled flowers in sessile cymes collected into terminal thyrses. Bracts and bracteoles small. Calyx short, equally 5-partite. Corolla 2-lipped, tube with a wide rather deep throat, straight or bent, upper lip with two somewhat reflexed toothed lobes, lower lip 3-lobed. Stamens 2 fertile exserted, inserted in the throat; anther-cells equal parallel, base muticose; staminodes 2, small. Capsule long-pedicelled. Ovules usually 2.

1. **G. pictum,** *Griff.* Syn. G. hortense, *Nees*; Justicia picta, *L.*; Caricature-plant.

A shrub 3–5 ft. high with large elliptic or broadly elliptic subsessile leaves 3–8″ long, variegated with white. Flowers dark red 1·5″ long in thyrses 2–4″ long.

Common in gardens. Native of Polynesis. "Tree up to 15 ft. with edible leaves." *Rev. Commins.*

28. RHINACANTHUS, *Nees.*

Shrubs or undershrubs with entire leaves and mod.-sized white flowers solitary or in small contracted cymes on the branches of dense or divaricate panicles. Bracts and bracteoles small linear-lanceolate.

Calyx small 5-partite, segments linear-lanceolate. Corolla 2-lipped with long slender tube, upper lip narrow acuminate entire or shortly 2-lobed, recurved or twisted, lower broad 3-lobed. Stamens 2, inserted near the top of the tube, anther-cells 2 superposed, muticous. Stigma minutely 2-fid. Ovules 2 in each cell. Capsule clavate with long solid basal portion. Seeds 4–2, ovoid, somewhat compressed, obscurely rugose or tuberculate, glabrous.

1. R. communis, *Nees.*

A slender divaricately-branched undershrub 3–4 ft. high with large elliptic, obovate or ovate-oblong leaves 3–9·5″ long by ·75–3·3″ broad narrowed into a petiole 1·5–2″ long (in the larger leaves). Flowers pure white, 1–1·3″ long, in clusters at the ends of the branchlets of large spreading, nearly naked, grey-pubescent, 3-chotomous panicles.

Singbhum, rocky ground under shade (Karampoda and Porahat forests), often on ridges 2500 ft. elev.! Ranchi (wild?), *Wood*! Hazaribagh (Koderma), *Gamble*! Puri! Nayagarh Ghats, Narsingpur! Sambalpur, *Cal. Herb.*! Fl., Fr. Dec.–April.

Branches striate, pubescent above. Leaves narrowed both ends, usually acuminate, puberulous or pubescent beneath; sec. n. about 5 very distinct. Bracts ·04–·06″, and deeply partite ·1–·12″-long calyx almost tomentose. Corolla-tube 1″, pubescent, upper lip ·3–·4″, shortly cleft recurved and with revolute margins, lower ·5–·6″ long with broad lobes ·3″ long. Capsule ·7–·8″. Seeds 4-2, ·17″ diam.

29. PERISTROPHE, *Nees.*

Erect herbs with entire leaves and small or mod.-sized deeply 2-lipped rose or purple flowers in 1-few-fld. small capitate cymules with 1–few pairs of decussate bracts longer than the calyx. Cymules often in spreading lax panicles. Bracteoles linear or lanceolate shorter than the bracts. Calyx small 5-partite, segments subequal, linear lanceolate. Corolla-tube slender, often twisted (as in *Diclip-tera*), so that anterior shortly 3-lobed lip becomes uppermost, posterior lip subentire. Stamens 2, filaments pubescent below, anther cells 2 muticous, one higher than the other or distant. Stigma minutely 2-fid. Ovules 2 in each cell. Capsule ellipsoid, stalked (with narrow base), more or less pubescent, placentæ *not* elastically rising from the base when ripe. Seeds ovoid, compressed glabrous, minutely glandular-papillose.

1. P. bicalyculata, *Nees.* Barge Khode baha, *S.*; Nasa-bhaga, *Beng.*

A laxly paniculately branched herb 3–6 ft. high with swollen nodes and sharply 6-angled stems, ovate acute or acuminate hairy leaves attaining 4·25″ by 2·75″ in lower part of stem, smaller upwards, and rather small bright rose-coloured or purple flowers in copiously-branched lax panicles, final branches bearing cymules of 2 sessile flowers, of which one is usually abortive. Capsule ·3″ oblong compressed with short solid stipes, beaked, glandular and puberulous.

Common in hedges and often a weed in compounds. N. Champaran! Chota Nagpur, all districts! Probably throughout the province. Fl., Fr. Dec.–March.

Stems hispid or hairy. L. hairy beneath or both sides, base somewhat decurrent on the 1·5–2″ long (lower) petioles, sec. n. about 8, upper leaves gradually passing into spreading setaceous bracts. Cymule bracts, larger linear-spathulate, ·3–·5″, smaller usually linear. Calyx ·17″ long, segments subaristate or setaceous upwards. Cor.-tube ·2–·25″, lips about ·25–·3″, oblong.

30. DICLIPTERA, *Juss.*

Erect or diffuse herbs with entire or undulate leaves and small or m.s. sessile or subsessile flowers collected, often together with imperfect flowers or their bracts, into fascicled capitate cymes in the axils of the leaves; fascicles also sometimes on short axillary branches. Ultimate cymes (cymules) enclosed between a pair of usually unequal dorsi-ventral bracts (cymule bracts)* and consisting of 1–2, rarely more, perfect flowers together with 2 or more imperfect flowers. Perfect flowers with narrow or setaceous proper bracts and bracteoles or these absent, imperfect flowers consisting of an empty calyx or reduced to bracteoles. Calyx 5-partite, segments sub-equal narrow, more or less pubescent. Corolla white, pink or red, purple-spotted; tube slender, upper lip narrow entire or emarginate, lower 3-lobed recurved. Stamens 2, anther cells 2 ovoid, superposed, muticous. Stigma shortly 2-fid. Ovules 2 in each cell. Capsule clavate with solid base, placentæ rising elastically from their base. Seeds ovoid compressed, verrucose or glandular-papillose, not hairy.

A. Flowers ·5–·6″ long. Proper bracts and bracteoles present:—
  L. lanceolate 1–3″, glabrous beneath. Cymule bracts mostly obovate, glandular-pubescent. Calyx ·2–·3″, glandular . 1. *Roxburghiana.*
  L. ovate, attaining 3·5″, hairy beneath. Cymule bracts nearly parallel-sided, shortly aristate, hairy. Calyx ·15–·18″, shortly hairy, not glandular . . . . . 2. *bupleuroides.*
B. Flowers ·25″ long. Proper bracts absent:—
  Cymule bracts oblanceolate, densely white-ciliate . . . 3. *micranthes.*

1. D. Roxburghiana, *Nees.*

A tufted herb from a stout woody rootstock (in old plants), with erect puberulous or strigillose stems 6–18″ high, rhomboid-lanceolate or narrowly- to broadly-lanceolate, acuminate leaves 1·5–3″, nearly glabrous beneath, thinly hairy or puberulous above. Flowers numerous rose-purple ·5–·6″ long in axillary peduncled bracteate capitate cymes. Cyme internodes above the first pair of bracts usually nearly obsolete. Bracts, bracteoles and calyx all glandular-pubescent not hairy. Cymule-bracts variable, from obovate to oblanceolate and linear, ·3–·5″, those in each pair unequal, acute or obtuse but not aristulate nor cuspidate. Calyx ·25–·3″ with filiform sepals in the perfect flowers. Capsule ·2–·25″, pubescent, not hairy.

Hills of Chota Nagpur. Ranchi! Palamau! Fl., Fr. March–June. Forest and waste-ground, coming up abundantly from the woody stocks after jungle fires and soon flowering.

Leaves cuneate at base, margins pubescent, sec. n. about 6, fine raised above. Petiole ·2–·3″. Axillary peduncles 1–3, ·2–·5″ long, bearing about 2 decussate pairs of foliaceous bracts or again ternate above the first pair, from linear to obovate on the same inflorescence. Cymule bracts 1-fid. or central pair 1–3-fid. Bracteoles

* Note.—In the axil of the main bract or floral-leaf there are one to several pairs of laterally placed bracts; these pairs each enclose a series of pairs of bracts (cymule bracts) placed posteriorly and anteriorly (or dorsally and ventrally in respect of main axis); these bracts which immediately subtend the cymule Clarke calls "proper bracts," but the bracts proper to each flower appear to me to be the narrow ones within the cymule itself or they may be altogether absent. The cymule perhaps normally consists of decussate pairs of flowers.

linear ·3″. Cor. pubescent, tube ·25″, three-toothed anterior lip becoming uppermost, ·4″, posterior (lower in actual position) entire subequal, ovate-lanceolate with recurved margins. Seeds usually 2, large discoid glandular-papillose, scarcely verrucose. Embryo large blue.

Var.

Habit of last. Leaves in a pair often very unequal, one with petiole attaining ·7″. Inflorescence more elongated. Pair of cymule bracts often connate at base, larger ·4–·5″ by ·08″ but very unequal. The cymule contains 3–5 fls. each with a slender bract and bracteoles and very shortly pedicelled. Bracteoles ·27–·28″ slenderly subulate. Calyx ·2–·3″, all glandular-pubescent as in the last. Style very slender ·6–·7″ long.

Appears to be a form of the same species with the cyme less contracted. Ranchi and Palamau, elev. 3000 ft.!

2. **D. bupleuroides,** *Nees.* Syn. D. Roxburghiana, *var.* bupleuroides, *Clarke.*

A tufted herb or undershrub about 18″ to 2 ft. high. Stems 4-angled and grooved and striate with swollen nodes, usually pubescent. on two sides and at the nodes. Leaves in a pair often unequal and one of a pair (subtending) the inflorescence often deciduous, larger 3·5 by 2″, ovate acuminate, very hairy beneath but hairs more or less deciduous with age, thinly pubescent or hairy above. Petioles ·5–1·2″. Fls. rose-purple in very compound axillary sessile cymes and terminating short axillary (or leaf-opposed, owing to fall of leaf) branchlets ·5–1·5″ long from the axil of the smaller (often deciduous) leaf. Cymule (pairs of) bracts in several transverse series, each series with 5–7 cymules enclosed between a pair of lateral bracts, the cymule bracts being anterior and posterior to the cymule. Larger bract ·4–·5″, 3-nerved, slightly linear-oblong, slightly wider upwards, cuspidate or shortly aristate, smaller bract similar but narrower and one-nerved, both with very long hairs. Bracteoles of perfect flowers ·27″, pubescent, setaceous. Calyx ·15–·18″ with the subulate-setaceous segments rather unequal. Corolla-tube ·23″ long, lips subequal, ·25–·3″, very pubescent or hairy. Capsule ·2–·25″, pubescent and villous excepting the short glabrous base.

Among hæmatite-schist rocks, on the mountains of Chota Nagpur. Singbhum! Fl., Fr. c.s.

L. sometimes with cuneate base and almost tomentosely hairy beneath when young, sec. n. strong beneath, 6-7. Corolla ·5″ long, hairy without, throat inflated, lips purple spotted with darker purple within, upper (anterior) minutely 3-toothed recurved, lower ·17″ broad entire. Anther-cells superposed, filaments hairy. Seeds 4 densely papillose.

Possibly intermediate forms between *D. Roxburghiana* and this species occur which induced *Clarke* to unite them, but in our area they appear to be quite distinct.

3. **D. micranthes,** *Nees.*

A herb with tough or sub-woody usually decumbent and rooting stems, somewhat angular above and with pale longitudinal lines. Leaves usually small, ·75–2″, ovate or rhomboid acute and apiculate or acuminate, cuneate at base, which tapers into a slender ·3–·5″ long petiole, very lineolate, glabrous or sometimes somewhat hispid

beneath. Flowers in dense whorls or contracted cymes (fascicles) at nearly every node. Ultimate cymules mostly of one perfect flower and 4 barren flowers or bracts enclosed between a pair of somewhat unequal oblong-obovate or oblanceolate hairy and densely white-ciliate bracts ·2–·3″ long with sub-squarrose awned tips. Calyx ·15″ with 5 narrowly subulate acuminate segments. Corolla ·25″, tubular part only ·1–·15″. Capsule shortly beaked. Seeds minutely hispid or glochidiate, ·06″ diam.

A weed of waste and cultivated ground. Behar, *J.D.H.*! Gya, *C. B. Clarke*! Ranchi, common, *H. G. Carter*! Manbhum, *Clarke*! Probably in most districts. Fl., Fr. c.s.

Leaves up to 3·5″ in some Bombay specimens, in ours always smaller, sec. n. 4–5. Sometimes several fascicles in an axillary vertical series with the inner shortly peduncled and sometimes fascicles also in interrupted spikes on short axillary branches. Outer lateral bracts shorter than the cymule bracts. Barren bracts or flowers usually ·2″, oblanceolate with scarious margins, hairy, and with straight sub-aristate tips. Corolla white (always?). The proper bracts and bracteoles, unless a pair of the barren bracts represent the latter, appear to be absent in this species.

31. ANDROGRAPHIS, *Wall.*

Herbs or small undershrubs with entire leaves and small flowers, usually erect on the branches of a spreading lax or very dense panicle or on axillary racemes, rarely racemes subcapitate or reduced to a single flower. Bracts small, and bracteoles minute or 0. Sepals equal, narrow. Corolla 2-lipped, white or pink or spotted, or lower lip purple, usually pubescent; upper lip sub-entire or deeply 2-lobed, lower 3-lobed. Stamens 2 (rarely 4 in *A. elongata*), filaments ciliate or setulose, rarely glabrous, anthers exserted with 2 oblong parallel, muticous subequal cells bearded at the base. Ovary thinly hairy, stigma minutely 2-fid. Ovules 3–9 in each cell. Capsule compressed transversely to the septum. Seeds 6–18, bony, oblong or subquadrate, not compressed, rugose-pitted, glabrous. Retinacula sometimes dilated at the tips.

The anterior lip of the corolla is usually perfectly erect in flower, the posterior spreading! In exceptional cases 4 perfect stamens may be found on the same plant with 2-staminate flowers.

A. Erect symmetrical herbs. Posterior lip of corolla entire or sub-entire, tube half as long as flower or more, or only little less:—
  Flowers all pedicelled. Leaves glabrous narrow acute . . 1. *paniculata.*
  Flowers sessile. Leaves hairy, oblong, obtuse . . . . 2. *echioides.*
B. Straggling, unsymmetrical. Posterior lip of corolla deeply 2-lobed, tube one-third or less length of flower:—
  Nearly glabrous. Flowers shortly pedicelled . . . . 3. *elongata.*

1. **A. paniculata,** *Nees.* Kalmeg, *K., S., H.*; Chiretta, *Beng.*; Bhuinimo, *Or.*

An erect herb 1–3 ft. high with square stems glabrous below, glandular hairy above, linear-lanceolate or lanceolate glabrous leaves 1·5–2·5″ long, and distinctly pedicelled white or pale-purple flowers, spotted purple, solitary and erect on the slender spreading sometimes compound branches of a large pyramidal panicle, of which the lower branches are from the axils of ordinary foliage leaves. Pedicles ·1–·4″ slender glandular-pubescent. Sepals ·1–·15″, subulate-linear, glandular.

Corolla ·3–·5″, tube half as long as whole corolla, or little less. Anthers purple. Capsule ·7–·8″, very sparsely gland-hairy, finally glabrous.

Common, especially on cleared stony lines in the forests. Patna, *T.T.*! Monghyr Hills, *Cal. Herb.*! Chota Nagpur, all districts, frequent! Santal Parganas! Angul! Sambalpur! Probably in all the districts in Central and Southern Areas. Fl., Fr. Sept.–May.

L. pale beneath microscopically punctulate and sometimes minutely puberulous, sessile or subsessile, sec. n. 2–3 exceedingly slender. Racemes divaricate, 2–4″ long with acicular bracts under ·1″. Posterior lip often appearing the lower, entire or minutely 2-toothed, anterior lip often erect and 3-lobed half-way down. Filaments very hairy. Seeds subquadrate, rugose.

In a form collected in the Santal Parganas the stems are narrowly sub-alate, leaves under 1·5″, pedicels all under ·1″ and capsule only ·5″ long.

The whole plant is very bitter and a decoction is used in fever and an extract as a medicine for the liver. *Campbell* says it is also given in diarrhœa, convulsions and epilepsy by the Santals. Its use is very general.

2. **A. echioides,** *Nees.* Bir-kubet, *S.*

An erect symmetrical herb 8″–2 ft. high with pubescent stems, sessile oblong rounded or obtuse leaves 1·5–3·5″ long pubescent or hairy both sides and pale, purple spotted, flowers ·5–·65″ long, sessile erect on divaricate simple or branched racemes from all the axils, the whole forming sometimes a large pyramidal but leafy panicle, but in early stages only lower leaves bearing racemes. Capsule ellipsoid-oblong, compressed, ·3–·4″, slightly hairy, sharp both ends.

Behar, *Hope*! Throughout Chota Nagpur, in similar localities to *A. paniculata*! Sambalpur, *Griff*! Probably throughout the area and common, but not always recorded. Fl., Fr. July–Jan.

Stems 4-angular. Branches sometimes villous with long white hairs. Leaves with usually broad rounded base, rarely some with cuneate base, sec. n. 5–7. Racemes ultimately exceeding the leaves, glandular-hairy, bracts minute. Lowest flowers sometimes shortly pedicelled but with pedicels shorter than the calyx, sepals glandular-hairy, linear, ·2–·3″ or sometimes ·4″ in fruit. Corolla like that of *A. paniculata*. Filaments thinly hairy, anthers dark-purple, densely white-bearded. Seeds somewhat oblong, rugose.

3. **A. elongata,** *T. Anders.*

A straggling herb 3 ft. long, with glabrous 4-angled stems 2–4 ft. long, ovate to lanceolate acute or obtuse leaves ·6–1″ long (or lower longer), glabrous, or above very minutely puberulous; and irregular lax branched racemes of 2-lipped flowers ·3–·4″ long and as broad. Pedicels shorter than the ·1–·12″ long glandular-pubescent calyx. Corolla with very short tube, posterior lip deeply 2-lobed, anterior deeply 3-lobed. Filaments dilated glabrous purple ·5″ long, anthers not or very slightly hairy. Capsule linear ·6–·7″ by ·09″ thinly glandular puberulous, 12–18-seeded.

Scrub jungles near the sea. Puri, in the south! Fl., Fr. March–April.

Angles of stem sub-alate or beaded. Leaves paler beneath with 2–3 sec. n. Petiole ·1–·2″ (those of fallen lower leaves were perhaps longer?). Racemes elongating to 6″, rhachis glabrous. Bracts mostly under ·1″ subulate or setaceous and usually a pair of smaller bracteoles at base of pedicel. Sepals narrowly subulate. Corolla-tube only ·1–·2″ long, broad at base, pubescent, lobes ·25–·3″ oblong 3-nerved. Stamens exserted, occasionally 4 (in same plant with 2-staminate flowers). Ovary pubescent, style hairy, stigma simple or minutely lobed. Seeds pale brown or yellow, somewhat shapeless, rugose, glabrous. The retinacula dilated at the ends.

Identified somewhat doubtfully with *A. elongata*, but the corolla-tube is shorter and the specimens of *A. elongata* do not appear to be glandular.

32. PHLOGACANTHUS, *Nees.*

Shrubs or tall herbs with entire, rarely obscurely crenate, usually large leaves and orange red or pink showy flowers in thyrses or narrow panicles, rarely simply racemose or in axillary cymes. Bracts small, bracteoles small or 0. Calyx deeply 5-fid with narrow segments. Corolla tubular curved so that the limb is oblique, limb 2-lipped, segments connivent patent or recurved, imbricate in bud. Stamens 2 and sometimes 2 small staminodes, anthers 2-celled, oblong, muticous, glabrous. Style simple and attenuate into the stigma, stigma pointed. Ovules 5-8 in each cell. Capsule elongate, sub-4-angled, many-seeded from the base. Seeds ovate-lenticular, glabrous or densely shortly hairy.

The *F.B.I.* and *Bengal Plants* give "bracteoles 0" as a generic character, but our species has bracteoles wherever collected by me from Dehra Dun to Bhotan!

1. **P. thyrsiflorus,** *Nees.* Chuhar, *Th.*

A handsome shrub 5–12 ft. high with large dark green glossy leaves and terminal thyrses of dark orange flowers. All parts of the inflorescence villously-tomentose or densely pubescent. Bracts and bracteoles linear. Calyx ·3″ with setaceous segments. Corolla ·5″–·7″ long with broad tube, tomentose.

Along the northern boundary, in the foothills. Bettiah! Ramnagar! Fl. Jan.–April.

Branches quadrangular. Leaves 6–9″ or sometimes up to 12″ long, oblanceolate, acuminate, tapering at base into a short petiole, sec. n. 10–12. Thyrses 6–10″ long, bracts ·5–·7″ long linear-acuminate, bracteoles similar, one-third to half as long. Flowers very shortly pedicelled. Upper lip curved, ·15–·2″ long with two short rounded lobes; lower lip spreading with 3 short more oblong lobes. Filaments stout, slightly pilose at base, anthers exserted from throat, shorter than upper lip, large. Capsule 1·25″, sub-4-angled, 12–14-seeded.

Leaves ground up with pepper are used for fever by the Tharus.

2. **P. curviflorus,** *Nees,* is a very handsome species with larger leaves than the last, often exceeding one foot in length. The thyrses are also stouter, 4–8″ long with the brick-red flowers 2″ long. It is sometimes cultivated in gardens. Native of the Khasia Hills.

33. BLEPHARIS, *Juss.*

Herbs or undershrubs, often rigid or prickly, with opposite or whorled sub-entire, sometimes unequal, toothed or spinose leaves. Flowers small or mod.-sized in 1-few-flowered, short or capitate spikes with opposite decussate bracts. Spikes terminal, often clustered on abbreviated axillary shoots. Sepals 4, unequal, paired, one of the outer pair emarginate or 2-lobed. Corolla with ovoid or urceolate tube and lipped limb, upper lip sub-obsolete, lower large 3-lobed. Stamens didynamous; anthers 1-celled, anterior below apex of filament, margins densely bearded, small rudimentary second cell sometimes present. Ovules 2 or 1 in each cell. Capsule oblong or ellipsoid. Seeds echinate by thick papillæ, their tips sometimes of free hairs when moistened, or hairs sometimes free from the base.

The hairs on the seeds are of interesting structure. *Vide F.B.I.*, p. 478; *Nat. Pflanz. Fam.*, "Acanthaceæ," p. 317.

The pair of bracts under the terminal flower are often termed bracteoles, their position (decussate with previous pairs, anterior and posterior to the flower) appears to connote them as bracts.

L. acute or obtuse, 1·5–3·5″. Corolla ·7–·8″ long . . . . 1. *boerhaaviæfolia.*
L. obtuse ·3–1″. Corolla ·25–·3″ long . . . . . 2. *molluginifolia.*

1. **B. boerhaaviæfolia,** *Pers.*

Undershrub or herb with creeping rootstock and diffuse stems 2–3 ft. long. Leaves mostly 4 in a whorl 1–3·5″ long, elliptic or ell.-oblong, subacute, acute or acuminate, rarely obtuse, cuneate at base, mostly remotely serrate or with few small teeth. Flowers white ·7–·8″ long, fascicled or solitary on abbreviated many-bracteate spikes conspicuous by the long marginal setæ of the bracts. Capsule broadly ellipsoid ·3″ long. Seeds 2, densely covered with stout white papillæ ·05–·08″ long branching into their component hyphæ at the tips.

In shady places, on rocky hills or along ravines. Monghyr hills, *Kurz*! Bihar, *J.D.H.*! Singbhum! Palamau! Angul! Fl., Fr. Aug.–March.

Stems attain ·25″ diam. with thickened nodes and often with a reflexed subhispid pubescence on the branches. Leaves sparsely hispid-hairy above, substrigosely hairy on the nerves beneath, sometimes in unequal pairs below. Petiole ·15–·25″. Bracts oblanceolate or spathulate, lower often only ·2″, uppermost ·3–·5″, 3-nerved, bristles often ·1–·15″ long retrorsely hispid. Outer sepals oblong, upper ·6″ long, inner and lateral shorter. Cor.-tube almost horny bulbous white, ·15–·17″ long with rim sub-truncate above, lower lip pubescent with pink veins, mid-lobe sometimes with 3 crenatures of which the central is emarginate.

2. **B. molluginifolia,** *Pers.*

A much smaller plant than the last with diffuse patently hairy stems 3–8″ long and narrow-elliptic (linear-oblong in some Bundelkhand specimens) to obovate rounded entire leaves usually only ·3–·7″, sometimes up to 1″ long. Heads sessile dense ovoid ·4″ with spinose-ciliate or awned bracts shorter than the bracteoles. Flowers usually only one in a head, ·25–·3″ long with corolla-lip only ·15″ broad, minutely pubescent.

Rare in our area. Purulia (Manbhum), *Clarke*! Fl. Sept.–Dec. It is found frequently to the west of our area in the United Provinces and Bundelkhand, so that it very probably occurs also in Shahabad and other dry western districts in our area, especially as it penetrates as far as Purulia.

34. ACANTHUS, *L.*

Shrubs or herbs with pinnatifid, toothed or spinous leaves, rarely scandent with entire (*volubilis*) leaves. Flowers subsessile usually large in dense strobiliform or interrupted terminal spikes with opp. and decussate spinescent bracts, and large lanceolate (rarely 0) bracteoles. Sepals in decussate pairs, 2 outer larger. Corolla with short ovoid horny tube, limb lipped, upper lip obsolete, lower elongate obovate, shortly 3-lobed. Stamens didynamous, shorter than the lip, curved below the anther, anther-cell one, apical on the filament, oblong, bearded. Disc 0. Style very shortly 2-fid. Ovules 2 in each cell. Capsule ellipsoid, compressed shining dark-brown, 4-seeded. Seeds compressed, glabrous.

A. Erect, leaves spinous or spinulose-serrate:—
  Shrub, leaves rigid glabrous shining. Cor. 1·5″ . . . 1. *ilicifolius.*
  Herbaceous, leaves soft. Corolla 1″ . . . . . 2. *leucostachyus.*
B. Twining, leaves not spinose nor spinulose, entire . . . 3. *volubilis.*

1. **A. ilicifolius,** *L.* Harkanchi, *Or.*; Harkat, *Beng.*

A very handsome small shrub 2–5 ft. high, with holly-like spinous rigid shining leaves mostly 2–4″ long and beautiful sky-blue flowers 1·5–2″ long in terminal spikes 3–6″ long or more. Capsule 1–1·5″.

Maritime marshes and ditches along the Orissa coast. Balasore! Mahanadi delta, Cuttack! Fl., Fr. April–June (perhaps also at other times).

L. subsessile, oblong, slightly contracted at base, sec. n. running out into spines. Bracts ovate, ·3–·5″, spinous-tipped, bracteoles similar but rather smaller. Large anterior sepal ·7″, nerves sometimes excurrent as two teeth. Lip oblong-elliptic entire, pubescent within. Anthers ·4–·5″ long, very shaggy.

The seedlings of this plant have linear entire leaves.

2. **A. leucostachyus,** *Wall.*

A stout herb 1–2 ft. high with somewhat decumbent woolly stems and short-petioled oblong serrate and spinulose-serrate leaves 4–8″ long and terminal hairy spikes of pale purple or white flowers about 1″ long (·7″, *F.B.I.*).

I have found this plant in wet ground in evergreen forest in the Jalpaiguri district and it may therefore occur in Purneah. Fl. March.

3. **A. volubilis,** *Wall.*

This has not been found in our area, but very probably occurs in the Mahanadi delta. It occurs in the Sunderbans twining among reeds (*Prain*).

FAM. 105. VERBENACEÆ.

Trees, shrubs or more rarely herbs, sometimes scandent by means of their sarmentose shoots, often fœtid or aromatic from minute glands, frequently with forked or stellate hairs. Leaves opposite or sometimes whorled, simple or rarely (*Vitex*) digitate, exstipulate. Flowers zygomorphic or sub-regular, small or mod.-sized, often showy, in variously formed inflorescences. Calyx gamo-sepalous, persistent and often accrescent, sometimes 2-lipped, rarely truncate, usually 4–5 lobed or -toothed (6–8-toothed in *Symphorema*). Corolla usually 2-lipped and 5-lobed, or two posterior lobes connate into one, sometimes subregular (many-lobed in *Symphorema*). Stamens usually 4, rarely 2 or (*Symphorema*) more than 4. Ovary of 2 or (*Duranta*) 4 connate carpels and 2-celled, or more usually *each carpel* divided more or less completely by a dissepiment into 2 cells, rarely only 1-carpellary by suppression or 2-carpellary with a free or nearly free central 4-winged column (*Avicennia*); never deeply divided as in the *Labiatæ*. Style usually slender with a 2-fid stigma. Ovules 2 to each carpel, usually laterally affixed to the infolded walls, more rarely near the base or pendulous from the apex (between the wings of the central column in *Avicennia*), micropyle always inferior. Fruit usually drupaceous with a 4 (1 by suppression) -celled stone or 4–1 pyrenes or partially connate drupels, more rarely quite dry, rarely 4- or 2-valved. Seeds as many as the ovules or fewer, exalbuminous in our genera.

The germination is epigeal in all cases observed, the cotyledons usually broadly oblong.

I. Inflorescence centripetal: spicate, racemose or rarely narrowly panicled. Ovules basal or lateral. (Genera 1–7):—
  A. Fls. sessile. Spikes simple:—
    1. Pyrenes or drupels 2 or 1, 1-seeded:—
      a. Spikes capitate. Fruit subglobose:—
        Calyx truncate or sinuate-dentate. Fruit succulent . . . . . 1. *Lantana.*
        Calyx 2-4-fid. Fruit dry . . . . . 2. *Lippia.*
      b. Spikes elongate. Fruit dry, oblong or linear. St. 2 . . . . . 3. *Stachytarpheta.*
    2. Pyrenes 4. Spikes elongate or capitate. Herbs . 4. *Verbena.*
  B. Flowers pedicelled. Racemes simple or panicled:—
    1. Ovary 1-carpellary, sub-2-celled. Frt. 2-1-seeded:—Scandent introduced shrub with blue flowers . . 5. *Petræa.*
    2. Ovary 2-carpellary, 4-celled. Pyrenes 2, 2-seeded . 6. *Citharexylum.*
    3. Ovary 4-carpellary, 8-celled. Pyrenes 4, 2-seeded . 7. *Duranta.*

II. Inflorescence centrifugal or composite, with partial inflorescences cymose (Genera 8–end):—
  A. Ovules lateral, amphitropous. Ovary more or less incompletely 4-celled:—
    1. Fruit drupaceous, sometimes dry but not capsular:—
      a. Flowers regular or nearly so:—
        Fls. 4-merous. Cymes axillary. Drupe with 4 (–1) pyrenes . . . . . 8. *Callicarpa.*
        Fls. 4–6-merous. Panicles terminal. Drupe with 4–3-celled endocarp . . . . . 9. *Tectona.*
      b. Fls. distinctly zygomorphic. Stamens didynamous:—
        i. L. digitate. Drupe with 4 (–1)-celled endocarp 10. *Vitex.*
        ii. Leaves simple:—
          * Drupe with 4 (–1)-celled endocarp:—
            Fls. small white. Drupe small, under ·3″ 11. *Premna.*
            Fls. 1″, yellow. Drupe over ·5″ . . 12. *Gmelina.*
          ** Drupe with 4 drupels or pyrenes:—
            Cor.-tube slender. Drupe exserted, usually succulent . . . . . 13. *Clerodendron.*
            Cor.-tube widened upwards. Drupe dry included in entire calyx. Large scandent shrub with red membranous calyx 14. *Holmskioldia.*
    2. Fruit sub-capsular, dry. Fls. zygomorphic . . 15. *Caryopteris.*
  B. Ovules apical, pendulous, orthotropous. Fls. subregular:—
    Cymes with an involucre of large bracts. Cor. 6-16-merous, white . . . . . 16. *Symphorema.*
    Cymes not involucrate. Corolla 4-merous, yellow . 17. *Avicenna.*

1. LANTANA, *L.*

Pubescent, scabrous or prickly shrubs, rambling or climbing, with 4-gonous branches and simple petioled, crenate, often rugose leaves. Flowers small, in peduncled capitate ovoid or cylindrical spikes. Bracts exceeding the calyx, bracteoles 0. Calyx small, membranous, truncate or sinuate-toothed. Corolla with slender tube and 4–5 spreading lobes. Stamens didynamous, included. Ovary 2-celled, style short, stigma oblique, subcapitate. Ovules 1 in each cell. Fruit drupaceous with 2 bony 1-seeded pyrenes. Seed without albumen, radicle inferior.

Branches strigosely-hairy, erect. Spikes elongate. Bracts obovate or ell.-ovate, outermost sub-involuciriform . . . . . 1. *indica.*
Branches mostly aculeate, spreading. Spikes in flower sub-umbelliform, not elongate. Bracts lanceolate . . . . . 2. *camara.*

1. **L. indica,** *Roxb.*

A shrub 3–8 ft. high with long rambling 4-angular strigose branches. Leaves mostly ovate coarsely crenate, 1–3·5″ long, rugose with impressed nerves and hairy with somewhat bulbous-based hairs above, beneath with usually matted hairs or sometimes nerves villous. Flowers light purple, scentless, in close heads ·3″ long, soon becoming ovoid or cylindric and elongating up to 1″ or 1·5″, on axillary peduncles rarely under 1″ in flower, up to 4″ in some cases in fruit. Bracts obovate, ovate lanceolate or ovate acuminate, hairy all over, less conspicuously fringed at the margins than in *Lippia geminata*, lowest often ·5″ long forming a kind of involucre to the spike. Fruit ·15–·2″ diam., purple when ripe.

Clarke says "on the river-banks of Bengal one of the commonest weeds"; *Prain* says "in most of the provinces" of Bengal, but he appears in this statement to have followed *Clarke*, as there is not a single genuine specimen of the plant from any of his provinces included in Behar and Orissa, and only very doubtful ones from other parts of Bengal! *Clarke* states that when not in fruit it is difficult to distinguish it from *Lippia geminata* (!). I can only conclude that contrary to his usual discrimination he often took the *Lippia* for this species and that *L. indica* is very rare in our area. Fl., Fr. Sept.–Jan.

L. sometimes ternate (as also in *Lippia*), rarely lanceolate but usually broadly ovate or subcordate (as never in *Lippia geminata*) and suddenly cuneate on the ·3″ long petiole, teeth in old leaves often ·1–·15″ broad, sec. n. 3–6. Calyx tubular, truncate, ·07″, densely pubescent. Cor.-tube ·25–·35″, pubescent, limb ·3″ across (back to front), lobes 4, all oblong rounded, anterior as long as posterior. (Both calyx and corolla quite different from *L. geminata*, *q.v.*) The large drupes are quickly evident in the spikes, which also easily distinguishes it from *L. geminata*.

2. **L. camara,** *L.* Syn. L. aculeata, *L.*; L. scandens (*Ind. For.*, Jan., 1901); Putus, *K.*

A straggling or scandent shrub with small recurved prickles on most of the branches. Leaves 2–3·5″ long, ovate or ovate-oblong with cordate or sub-cordate base cuneate or decurrent on the short petiole, rugose above. Flowers usually orange, varying to white or purple, with a strong smell of black-currant, in short spikes appearing superficially subumbellate when young. Cor.-tube very slender, ·4″, pubescent; limb ·3″ across (back to front), upper lip sub-quadrate, similar to lower lip, side lobes rounded. Drupe greenish-blue.

Running wild in Horhap and a few other places. Native of Central America and very commonly planted as hedges. In parts of India (Berar, Coorg, etc), the plant has proved a terrible pest.* Fl., Fr. nearly all the year round.

A form with the stems more aculeate constituted *L. aculeata*, *L.*, while some forms have the prickles very minute. L. scabrid above, shortly villous on the nerves beneath. Peduncles equalling or exceeding the leaves. Bracts lanceolate strigose equal, shorter than the corolla.

2. LIPPIA, *L.*

Shrubs or undershrubs, rarely herbs, with opposite or whorled, rarely alternate, often aromatic, leaves and usually small or very small flowers sessile in the axils of small bracts in axillary heads or spikes. Bracteoles small or 0. Calyx small, with 2–4-cleft or 4-toothed or with 2-ribbed or 2-winged tube. Corolla with straight or curved tube often somewhat widened upwards, limb somewhat 2-lipped, 4-

* See *Indian Forester*, Jan., 1901, also Nov., 1919, where the leaves have been suggested as a substitute for tea.

lobed. Stamens 4 didynamous. Ovary 2-celled (formed of one carpel). Ovule one in each cell. Fruit dry, small, and included in the calyx, with hard pericarp and 2, 1-seeded, easily separable pyrenes.

Flowers in dense spikes or capitula with persistent bracts:—
Shrub with aromatic leaves . . . . . 1. *geminata*.
Creeping herb with cuneate-spathulate serrate leaves . . . 2. *nodiflora*.
Flowers in lax panicled spikes with caducous bracts:—
Sweetly lemon-scented shrub. Cultivated . . . . . 3. *citriodora*.

1. **L. geminata,** *H.B. & Kunth.* Naga-aieri, *Or.*; Wild Sage (of English denizens).

A gregarious shrub with numerous erect weak scarcely angled hairy branches 3–5 ft. high and also long procumbent ones, and aromatic, mostly lanceolate or oblong, closely crenulate or crenate-serrate leaves 1·5–2·5″ long with impressed nerves and thinly hairy and punctate above. Flowers pink, scented, in capitate spikes ·3″ long elongating to ·7″, rarely to ·75″ on axillary peduncles ·3–·5″, very rarely 1″ long (under shade). Bracts ovate acuminate white-villous at the edges, lowest ·2–·3″ long. Fruit ·08″ diam., globose with sub-succulent green pericarp when unripe, ultimately dry and splitting into 2 pyrenes.

Along muddy river banks and wet places. Very common in the eastern districts of the Northern Tract! Along the Ganges at Bankipur, etc.! Rivers on the Ranchi plateau! Sand-dunes and mud-banks, Balasore! Puri! Fl., Fr. March–Dec.

Branches with numerous minute glands and spreading hairs. L. rarely ovate or suddenly cuneate on petiole (cp. *Lantana indica*), usually narrow with gradually tapering or cuneate base, somewhat hoary beneath, teeth 1–3 to ·1″; sec. n. 6–7 conspicuous beneath with many intermediate, villous. Petiole ·2–·5″. Bracts closely hairy. Calyx of 2 oblong obtuse concave silky lateral lobes, free on the anterior face, slightly connate at base above. Corolla hairy, tube ·2″, throat yellow, limb ·15″ from back to front, upper lip with 2 small rounded lobes much shorter than the lower lip, which has a shovel-shaped blade.

"Used as sage in cookery." *Tweedie.*

2. **L. nodiflora,** *Rich.*

A prostrate herb with opposite cuneate-obovate serrate obtuse leaves ·5–1″ long and axillary peduncled bracteate heads of small white flowers. Fruit ·08″ diam. of 2 pyrenes, embraced by the two-fid calyx and bracts.

A weed of wet ground, probably occurring in most districts. Darbhanga, *Cal. Herb.*! Singbhum! Balasore! Puri! Fl., Fr. practically all the year round.

Strigose with short hairs. L. with few appressed hairs beneath, sec. n. obscure, petiole hardly any. Peduncles ·25–3″ long. Heads ·12–·25″ diam., at first very short, finally elongating to ·3–·5″. Bracts obovate or sub-orbicular, shortly acuminate. Calyx 2-fid, shortly pubescent. Corolla ·1″ long, sub-2-lipped with 5 short lobes, lowest largest, 2 upper smallest. Style short, stigma oblique.

3. **L. citriodora,** *Kunth.*,

is the well-known Lemon-scented Verbena (Syn. *Aloysia citriodora, Ort.*), of horticulturalists. Leaves and panicled spikes and fls. ternate.

Native of South America.

3. STACHYTARPHETA, *Vahl.*

Shrubs or herbs with toothed leaves and rather small flowers in long slender terminal bracteate spikes. Bracteoles 0. Calyx tubular,

shortly 4–5-toothed. Corolla with cylindric, straight or curved, slender (or towards the top widened) tube and oblique patent equally or unequally lobed limb. Stamens 2 included with ovate anther-cells vertically divaricate; staminodes 2 small posterior. Ovary 2-celled, of one carpel, each cell 1-ovuled. Style elongate with terminal somewhat capitate stigma. Fruit elongate, dry, included in the calyx, of 2 hard 1-seeded pyrenes.

Herbaceous. Flowers blue	1. *indica.*
Shrub. Flowers red	2. *mutabilis.*

1. **S. indica,** *Vahl.* Syn. S. jamaicensis, *Vahl*; Jalajali, *Or.*

A herb 1–3 ft. high with terete stems and somewhat 4-sided branches, mostly dichotomous. Leaves nearly glabrous, elliptic, sub-obtuse or acute, 2–4″ long. Flowers blue, rather pretty in young plants but becoming very weedy with the elongation of the spike which often attains 12″ or more, with lanceolate bracts as long as the oblique 4-toothed calyx. Fruit ·12–·17″ long.

Often occurring as a weed and sometimes a pest after ploughing a compound. Ranchi! Singbhum! Purulia, *Milne*! Naturalised in the open laterite forests of Puri! Fl., Fr. r.s. Native of America.

Leaf base decurrent. Flowers sunk in the rhachis of the spike. Calyx ·2″, 4-nerved. Corolla ·3–·5″.

2. **S. mutabilis,** *Vahl.*

A shrub 3–5 ft. high with 4-angled tomentose-villous branches and ovate or ovate-oblong acuminate rugose leaves 2–4″ long, sparsely villous and scabrid above, densely villous or woolly beneath. Flowers scarlet and rose, sunk in the rhachis of spikes which attain 2 ft. in length. Bracts acuminate.

Often grown in gardens. Native of tropical America.

4. VERBENA, *L.*

Herbs or undershrubs with opposite or ternate toothed or pinnatifid leaves and small or mod.-sized flowers in simple or corymbose terminal spikes with small bracts and bracteoles. Calyx tubular, 5-toothed. Corolla with straight or curved tube and weakly 2-lipped limb with 5 spreading lobes. Stamens didynamous, included, anthers ovate 2-celled. Ovary 2-carpellary, more or less 4-lobed and 4-celled, each cell with 1 ovule attached laterally near the base. Fruit included in the calyx breaking up into 4 (or fewer by abortion) oblong pyrenes.

The beautiful garden *Verbenas*, of which especially the scarlet one *V. chamædrifolia, Juss.*, grows well in Chota Nagpur, consist of several species and their hybrids and varieties obtained by intercrossing. They are mostly Argentine and Brazilian.

1. **V. officinalis,** *L.* Vervain, *Eng.*

A decumbent and erect herb 1–2 ft. high with 4-angular branches and oblong or ovate toothed, or lower pinnatifid, leaves 2–4″ long and elongating spikes of small lilac flowers ·17″ diam. Pyrenes truncate, granulate on the inside, smooth dorsally, 3-ribbed.

Occasional. Santal Parganas, *Roxb.*! Chota Nagpur! Fl., Fr. c.s Rootstock woody. Branches and leaves hispidly pubescent. Leaves mostly 3-partite with obtuse or acute lobes, upper narrower. Spikes elongating to 10″.

This little plant is very widely distributed and is frequent by waysides and on rubbish-heaps in England. The plant was held in great veneration by the ancients (in Europe), being used in sacrifices and at other religious ceremonies.

5. PETRÆA, *L.*

Scandent rarely erect shrubs with opposite coriaceous entire leaves and violet, purple or blue flowers, shortly pedicelled in the axils of bracts scattered on the rhachis of long terminal racemes. Calyx turbinate at the base, 5–15-costate with 5 spreading equal beautifully-coloured lobes longer than the tube, persistent rigid and reticulate after flowering; scales in the throat opposite the sinuses. Corolla with short cylindric tube and oblique broadly spreading 5-fid limb with obtuse usually unequal lobes. Stamens didynamous, included. Ovary on an elevated disc, imperfectly 2-celled, cells 1-ovuled. Fruit coriaceous sub-fleshy, indehiscent, included in the calyx-tube.

1. **P. volubilis,** *Jacq.*

Very beautiful when in flower with ovate elliptic or oblong rather harsh leaves 3–5″ long and racemes of star-like flowers with spreading pale blue calyx exceeding the deep violet corolla. Calyx-lobes linear, tube with pubescent scales at the mouth. Anterior corolla-lobe with a white spot at base.

Frequent in gardens. Native of tropical America. Fl., Feb.-April, also sometimes in October.

6. CITHAREXYLUM, *L.*

Trees or shrubs. Flowers rather small racemose or pedicelled axillary. Calyx truncate or shortly 5-lobed, spreading under the fruit or cupular and shorter than the fruit. Corolla limb 5-fid. Ovary sub-4-celled with one ovule in each cell. Fruit a succulent drupe with 2 hard 2-celled pyrenes.

1. **C. subserratum,** *Swartz.* Fiddle Wood.

A small tree with glabrous ovate elliptic or obovate petioled leaves, shining above and remotely shallowly serrate towards the apex. Flowers small white very fragrant in long drooping racemes.

Often planted. Native of America. Fl. r.s.

7. DURANTA, *L.*

Shrubs, sometimes very large, with opposite or whorled leaves, often bearing axillary thorns, and small flowers in the axils of small alternate bracts in terminal racemes, rarely axillary. Calyx tubular or subcampanulate, truncate or minutely 5-toothed, accrescent in fruit and including it, and often constricted at the apex. Corolla with straight or incurved tube and spreading oblique or equally 5-fid limb. Stamens didynamous, included. Ovary almost perfectly 8-celled (4–2-celled carpels), each cell 1-ovuled. Style short, stigma

unequally 4-fid. Fruit a drupe with succulent pericarp and 4 hard 2-celled, 2-seeded pyrenes. Seeds exalbuminous.

1. **D. Plumieri,** *Jacq.*

A large shrub or sometimes almost a tree with weeping branches, usually thorny. Leaves obovate or elliptic with cuneate base tapering into a short petiole, entire or serrate above the middle, about 1″ long. Flowers blue or white, in terminal and axillary sometimes sub-panicled drooping racemes. Calyx teeth triangular-subulate. Drupe globose yellow about ·25″ diam.

Very commonly planted and makes an excellent hedge, especially in the damper districts. Fl., Fr. most of the year. Native of Mexico and the West Indies.
D. Ellisia appears to be a white-fld. variety with the branches often unarmed.

8. CALLICARPA, *L.*

Trees or shrubs with the young parts stellately tomentose. Leaves usually large. Flowers small, often glandular, in axillary usually corymbose dense peduncled cymes. Calyx very small, 4-lobed. Cor. subregular, tubular with 4 (–5) lobes, lilac, purple or red. St. 4–5 exserted. Ovary imperfectly 2-celled with long style and capitate sub-entire or 2-lobed stigma. Drupe small, with 1–4 free pyrenes.

Tree. Leaves entire. Drupe purple . . . . . 1. *arborea.*
Shrub. Leaves crenate. Drupe white . . . . . 2. *macrophylla.*

1. **C. arborea,** *Roxb.* Bomud, Bodudn, *K.*; Dam Kotokoi, *S.*; Bagodi, *Kharw.*; Sakarla, *Mal Pah.*; Boro, *Or.*

A small or mod.-sized tree with compressed 4-angled densely tomentose branchlets, large ovate to ovate-lanceolate or ovate-oblong acute or sub-acuminate entire leaves 5·5″ by 2·75″ to 12″ by 5·5″, densely stellate-tomentose beneath (both sides when young), and small lilac-purple flowers in 2-chotomous corymbose cymes 3–5″ diam. on peduncles 1–2″ long which exceed the petioles. Drupe purple.

In the damper districts and hills of the drier ones. Champaran! Purneah! Hills, on north aspects or ravines, in Singbhum, Ranchi, Manbhum and Palamau in Chota Nagpur, but only scattered! Dhadka (Manbhum), *Wood*! Common on the northern slopes of the Parasnath range! Rajmahal Hills, frequent! Bhuyia Hills, Keonjhur, *Grieve*; Bonai, *Cooper*! Mals of Puri, frequent! Fl. Oct. and April–June. Fr. Aug.–Nov. and Dec.–Jan. Evergreen.

Attains 3–4 ft. girth, but of small height, crown spreading. Bark light or sand-coloured; blaze soft, white with yellowish streaks. L. usually about 6-9″, the stellate hairs not stipitate nor with a second whorl of branches below the top as in the Deccan *C. lanata* (but a specimen from the Puri Hills showed a tendency towards hairs of this character and *C. lanata* may occur in Kalahandi), margin rarely slightly toothed, base rounded; sec. n. 8–12 with strong scalariform tertiaries. Petiole ·6–1·5″, those of a pair often unequal. Cor. ·12″ diam. Drupe ·1–·12″ diam., seated on the small spreading calyx, finally black.

Wood only used for fuel and charcoal. "Growth fast, 5 rings per inch (but probably slower in our area). Wt. about 35 lbs." *Gamble.*

2. **C. macrophylla,** *Vahl.* Bundudn, *K.*; Buddhi-ghassie', *S.*; Mathara, *Beng.*

A stout shrub with the branches, leaves beneath and inflorescence densely stellately woolly. Leaves 5–10″ long, elliptic, rarely ovate-lanceolate, long acuminate, crenate or crenate dentate. Flowers

rose-coloured in dense 2-chotomous cymes about 1″ long and 2″ diam., peduncles ·3–1″ long. Drupe ·12–·18″ diam., white.

Edges of forest, steep slopes and ghats, open jungle and waste land. Champaran! Purneah! Ranchi ghats and Porahat plateau, frequent! Singbhum, rare! Palamau! Manbhum, *Camp.*! Fl. Aug.–Nov. Fr. Oct.–Dec. Evergreen.

L. 1·7–4·5″ broad, base usually rounded, upper surface more or less stellate; sec. n. strong, 10–15. Petiole ·5–1·5″. Calyx ·05″ with 4 minute teeth. Corolla ·06″.

9. TECTONA, *L.f.**

Large trees with stellate and simple tomentum, and opposite or ternate large entire leaves. Flowers small in many-flowered 2-chotomous cymes disposed in large terminal panicles. Bracts minute. Calyx campanulate, shortly 5–6-fid, in fruit accrescent, bladdery or ovoid-urceolate with the mouth closed. Corolla with short tube and spreading 5–6-fid limb, lobes subequal, short. Stamens 5–6, inserted almost at the base of the corolla, equal, exsert. Ovary of 2 2-celled carpels, each cell with one lateral ovule. Fruit subdrupaceous, exocarp nearly dry, endocarp bony 4-celled with a central lacuna. Seeds erect, oblong, exalbuminous, with membranous testa.

The endocarp, like some other genera of the family, is supplied with lateral valves to the cells, not reaching the apex of the seed, which are thrown off on germination. Germination epigeal.

1. **T. grandis,** *L.* Sagun, *H.*; Rang, *K.*; Singuru, Sagwan, *Or.*; Teka, *Gondi*; Teak.

A large tree, but rarely over 50 ft. high and 4 ft. girth in our province, with 4-sided and channelled branches and large elliptic or obovate leaves 1–2 ft. long, scabrid above, with close stellate tomentum beneath. Flowers white, short-pedicelled, in large erect terminal brachiate panicles 1–2 or sometimes 3 ft. long, with short lanceolate bracts. Calyx ·12–·17″ in flower, large inflated and 1–1·5″ diam. in fruit. Corolla ·2–·25″ long, throat glabrous. Drupe with a thick spongy covering composed of matted hairs, endocarp with 1–4, usually 1–2 seeds.

Indigenous teak only just enters our province in the south-west, and is confined to the west of Kalahandi and south-west corner of Patna State. *Grieve, Cooper*! There is also about 80 acres of natural teak in the Baud State on the banks of the Tel River, *Cooper*. Whether it was ever indigenous in Orissa proper is doubtful. If so it was completely destroyed. There are, however, plantations in Puri and small ones in Angul, and the former are fairly promising. Fl. July–Aug. Fr. Nov.–Jan. Deciduous Dec.–April.

Small glands occur in most parts especially in the seedling. The cotyledons after germination are somewhat fleshy, broadly elliptic-ovate, about ·5–·6″ long with a short petiole. The young seedling leaves are hispid, denticulate or crenate, hairy beneath.

The uses of teak are too well known to need description. The leaves contain a red pigment which gives rise to the Kol name.

10. VITEX, *L.*

Trees or shrubs, often glandular and aromatic or fœtid, with opposite or 3-nately whorled digitately 3-5- rarely 1-foliolate leaves and rather small lipped flowers in panicled or dichasial cymes. Calyx

* For a most excellent short account of teak see *Brandis, Forest Flora*, p. 355.

campanulate or tubular-camp., shortly toothed or truncate, usually enlarged in fruit. Corolla with upper lip 2-lobed, lower 3-lobed with mid-lobe larger. Stamens didynamous. Ovary 2–5-celled, style filiform, stigma unequally 2-lobed. Drupe with 1–4-celled bony putamen.

I. Panicles mainly terminal, primarily centripetal, lateral branchlets cymose:—
  A. Panicles rather dense, lower cymose branchlets elongate, so that the panicle is pyramidal or subcorymbose:—
    L. 3-foliolate, lflts. sessile. Panicles fulvous-tomentose . 1. *pubescens.*
  B. Panicles or their main branches linear-oblong, usually lax; cymose branchlets all short subequal and few-fld.:—
    L. 3–5-foliolate, central lflts. petioluled, hoary tomentose beneath . . . . . 2. *negundo.*
    L. 1–3-foliolate, lflts. all sessile, hoary beneath . . . 3. *trifolia.*
    L. 3-foliolate. Lflts. shortly petioluled, glabrous . . 4. *pedunculariis.*
II. Panicles axillary, wholly cymose and dichasial:—
  Lflts. 3–5, narrowly-ell.-lanc., 1–4·5′ Fls. white . . . 5. *leucoxylon.*
  Lflts. 5, ell. or obovate, 3·5–8″. Fls. purplish . . . 6. *glabrata.*

1. **V. pubescens,** *Vahl.* Muria, *Or.*

A small or mod.-sized tree with 3-foliolate (3–4-foliolate, *F.B.I.*) leaves, sessile ovate or elliptic-lanceolate acute or acuminate leaflets 3–6″ long, minutely closely pubescent and strongly-nerved beneath; and mod.-sized blue or purplish glandular and tomentose flowers in rather dense pyramidal or sub-corymbose cymose panicles. Drupe black, ·4″ diam., somewhat depressed-globose.

Puri forests, frequent, often on laterite or sandstone! Fl., Fr. Oct.-Dec. Evergreen.

Crown rather spreading. Branchlets closely minutely pubescent or tomentose. Lflts. rarely 8″ by 3″, coriaceous, upper surface closely puberulous; sec. n. of terminal lflt. 12–18, strong almost to the margin, and with sub-parallel cross close tertiaries. Petiole 1·3–2″ (3′, *F.B.I.*). Panicle minutely tomentose with subfoliaceous ovate or obovate persistent bracts ·25–·5″ long. Calyx tomentose. ·3–·4″ diam. and often unequally split in fruit. Corolla ·4–·5″. upper lip ochroleucous (*F.B.I.*) or purplish (in my specimens). Endocarp very thick, 4-1-celled, usually 1-seeded.

Gamble states that the wood is durable and is used for various purposes in South India. He gives the weight as 52 lbs. It does not appear to be much used in Orissa except for the usual purposes of petty construction and fuel, for which it is well suited as it is a good coppicer.

2. **V. negundo,** *L.* Bigana, Sursing, *Ho.*; Huri, *M.*: Sindware, *S.*; Sinoar, *Kharw.*; Shivari, Sambhalu, *H.*; Nishinda, *Beng.*; Begunia, Nirgundi, *Or.*

A large strongly-scented shrub, 6–12 ft., or sometimes subarboreous, covered with a fine hoary tomentum, with 3–5-foliolate leaves and white or lavender flowers in oblong panicles 2–8″ long. Leaflets lanceolate or narrowly lanceolate acuminate, entire or crenate. Drupe globose, ·12″ diam.

Frequent in waste ground and hedges in all the districts and sometimes near river-banks! Usually near villages and perhaps introduced? Fl., Fr. most of the year. Evergreen.

Lflts. 2–6″ long, puberulous or glabrescent above, lateral sessile or subsessile, others with petiolules ·5–1″ long. Cymules usually distant on the strict short branches of the panicle, ·5–·75″ long. Calyx hoary ·1″ long. Corolla ·25–·3″ across long diam., puberulous or tomentose outside, palate hairy.

Var. **incisa,** *Clarke.* Syn. V. incisa, *Lamk.*

Lflts. cuneate-serrate or sub-pinnatifid. Occasionally mixed with normal form.

Var. **densiflora.** L. all 3-foliolate. Lflts. smaller, 1–3″, more broadly lanceolate. Panicles almost thrysiform. Corolla very tomentose, only ·25″ on long diameter.

Along the Sone, Palamau!

The root is tonic, febrifuge and expectorant, and the leaves tonic and vermifuge. A decoction with long pepper is given in catarrhal fever. *Dutt.*

3. **V. trifolia,** *L.f.*

Differs from *V. negundo* in the leaves only 1–3-foliolate, lflts. all sessile obovate or obovate-oblong entire, subobtuse. Calyx ·12–·17″. Corolla ·3–·5″ diam., tomentose.

Scattered throughout India, *Clarke.* There are no specimens from our area.

4. **V. peduncularis,** *Wall.* Simjanga, *K.*; Mara-kata (Peafowl's foot), Bhadu, *S.*; Mado-chulia, *Or.*

A small or mod.-sized tree, with pubescent shoots and 3-foliolate leaves, leaflets narrowly elliptic or lanceolate, 3–7″ by 1·25–2″, glabrous, concolorous both sides, minutely gland-dotted beneath, punctulate above. Petiole often winged (always in the young plants). Flowers white with yellow palate, cymose in narrowly oblong or lanceolate slender lax panicles 6–11″ long and exceeding the leaves. Drupe somewhat obovoid, ·35–·4″ long and ·3″ diam. with 3–4-celled endocarp.

Central and Southern Areas. Valleys and on northern rocky slopes. Gaya ghats! Singbhum, frequent in the moister forests! Manbhum! Hazaribagh, attaining large size on the northern slopes of Parasnath! Koderma! Palamau! Santal Parg., frequent! Puri, not very common! Angul! Sambalpur! Mayurbhanj! Fl. April–June. Fr. Aug.–Sept. Evergreen.

Usually about 3 ft., but attains 5 ft. girth and about 50 ft. in height with light-brown nearly smooth bark. Blaze with chlorophyll in young trees, light yellow or cream and sometimes streaked with brown, rapidly turning darker on exposure. Lflts. acuminate with 12–20 very slender sec. n. Petiole 1·5–3″. Petiolules ·15–·2″. Lateral branches of panicle 1″ or less long, lower dichasial, upper 3-flowered, minutely appressed pubescent. Bracts subulate ·05–·07″. Calyx campanulate ·06–·08″ only in flower, minutely pubescent or sometimes with 5 pubescent lines and glandular with yellow glands, very minutely toothed. Corolla-tube ·1″, puberulous and with minute yellow glands, upper lip very short erect with 2 oblong obtuse lobes, lateral lobes rather longer, anterior lobe four times as long, shovel-shaped with short base, pubescent.

Wood good for yokes. Wt. about 60 lbs. *Col. Vaughan* believes that in an infusion of the leaves of this plant he has found a specific for black-water fever. If so it will become of great importance.

The form with winged petioles is called var. **Roxburghiana,** but all seedlings have winged petioles and these persist sometimes to maturity.

5. **V. leucoxylon,** *L.f.* Chirai-gori, *Bhuia* (Bonai).

A large shrub or a mod.-sized tree with pubescent or silky shoots and 3–5-foliolate nearly glabrous leaves with narrowly-elliptic-lanceolate acute or acuminate leaflets, 1–4·5″ by ·3–1·5″ entire or (in very young plants) serrate, dark and shining above, paler beneath. Flowers white, ·5″ on the greatest diameter, in divaricate dichasial axillary long-peduncled glabrous cymes 2–4″ wide. Drupe ellipsoid,

·6–·75″ long, seated on the scarcely-lobed accrescent ·3–·4″ diam. calyx.

Along river banks only. Hazaribagh, near Pachamba! Gangpur! Bonai, *Cooper*! Sambalpur! Fl. May–June and Oct. Fr. Feb. Evergreen. Planted in Purneah.

Bark dark-coloured. Petioles 1–3″ slender. Lflts. sometimes narrowly oblong-lanceolate, coriaceous, usually woolly or hairy each side of the midrib, sec. n. scarcely raised beneath, 8–12. Petiolules slender ·25–·8″. Cymes with usually 2 linear bracts ·75″ long at the first fork only, peduncle 1·5–3″, slender glabrous. Fls. often sub-sessile in the forks. Calyx ·12–·14″ in flower, slightly pubescent, teeth broadly triangular. Corolla densely appressed silky outside, about twice as long as the calyx, mid-lobe of lower lip ·25″, villous.

Said to be in demand in the Madras Presidency as a useful wood. Wt. 42 lbs., *Gamble*.

6. **V. glabrata,** *R.Br.* Syn. V. bombacifolia, *Wall.*; Bhadu, *S.*

A tree, often large and attaining 6 ft. girth, with thinly pubescent shoots and tomentosely hairy buds, mostly 5-foliolate leaves very like those of a *Simul* tree, with large leaflets permanently sparsely appressed-hairy or finely puberulous beneath. Flowers purplish-blue or white with a bluish lip, ·3″ long, ·6″ diam. in very regular dichasial panicles, each fork with a shortly pedicelled flower. Drupe oblong-obovoid, ·5–·75″ long.

Rajmahal Hills, usually along streams but ascending to the tops of the hills in favourable situations! Mayurbhanj Hills, elev. 2–3000 ft.! Fl. May–June. Fr. June–July. Evergreen?

Bark smooth grey; blaze white, yellowish on the wood. Twigs light-grey somewhat 4-sided. Petiole 2·5–6″. Lflts. elliptic, broadly-ell. and obovate, 3·5″ by 2″ to 8″ by 4″, mostly suddenly acuminate or caudate, glabrous and shining above, base usually cuneate, sec. n. 8–14 rather strong, tertiaries obscure; petiolules ·6–2″. Panicles 4–6″, peduncles 2–4″. Flowers with pedicels ·12–·17″ long. Calyx campanulate in flower, ·12″, deeply saucer-shaped and ·25–·3″ diam. in fruit. Corolla densely grey-pubescent, throat and base of lip villous with often purplish hairs, upper lobes rounded, reflexed, midlobe of lower lip shortly quadrate then concave orbicular.

The timber of this tree is said to be good and is largely used in Assam. In our province it has hitherto been given no protection.

11. PREMNA, *L.*

Trees or shrubs or (*P. herbacea*) a low herb with usually distinctive fœtid or aromatic smell, opposite or ternate entire or toothed, often unequally paired leaves and small, often polygamous, greenish or white sub-regular or 2-lipped flowers in pubescent usually corymbose cymose panicles. Calyx small, 2–5-toothed or sub-entire, sometimes lipped. Corolla tubular, throat hairy, petals 4–5. Stamens didynamous, usually exserted. Ovary of 2 completely or incompletely 2-celled carpels. Fruit a small drupe with 1–4-celled stone, seated on the usually cupular calyx; endocarp usually rugose or verrucose, often with a central lacuna and with usually two basal cavities in connection with it; these may be filled with soft tissue.

I. Large woody climbers, calyx truncate:—
  L. mostly oblong or lanceolate, finely caudate, 3–7″. Fls. ·08. Sub.-Himalayan species . . . . . 1. *scandens.*
  L. broadly oblong or ovate, shortly caudate, 5–10″. Fls. ·1″. Peninsula species . . . . . 2. *coriacea.*

II. Erect trees or shrubs, calyx more or less lipped or toothed :—
A. Calyx 2-lipped (see also 8) :—
1. Calyx tubular-campanulate, lips entire rounded or one with 2 rounded or shortly linear lobes :—
a. Unarmed trees, sweetly aromatic with small glands :—
L. 5–10″ entire, closely villous-pubescent beneath — 3. *flavescens.*
L. 7–12″, often toothed, not closely pubescent — var. *gmelinoides.*
b. Small thorny tree. L. 1–4″, entire or crenate — 4. *integrifolia.*
2. Calyx with one lip 2-lobed or -toothed, the other with 3 smaller lobes or teeth :—
Small thorny tree. Leaves obtuse — 4. *integrifolia.*
Small unarmed tree. L. 4–6″, serrate, acuminate. Calyx-lobes rounded, venose in fruit — 5. *calycina.*
B. Calyx not lipped, with 4–5 equal teeth (sometimes lipped but teeth equal in 8) :—
1. Leaves more or less serrate (rarely quite entire in 6) :—
Calyx with 4 linear or oblong teeth. L. drying green — 6. *barbata.*
Calyx with deltoid teeth. L. drying blue or black — 7. *latifolia* (var.).
2. Leaves entire :—
a. Not stellately tomentose :—
L. drying blue or black. Unarmed tree or shrub — 7. *latifolia.*
L. drying more or less green. Thorny when young — var. *Gamblei.*
b. Stellately tomentose, especially the panicles :—
L. elliptic, base not cordate. Corymbs 6–8″ diam. — 8. *bengalensis.*
L. ovate with cordate base. Panicles pyramidal 2–4″ diam. — 9. *tomentosa.*
III. Shoots herbaceous with spreading leaves appressed to the ground — 10. *herbacea.*

1. **P. scandens,** *Roxb.* Syn. P. coriacea var. oblonga, *Clarke.*

A large woody climber, with membranous young leaves growing coriaceous with age, oblong or lanceolate, seldom ovate-oblong, always long very finely caudate, quite entire, glabrous, 5–10″ long. Flowers very small, green, in irregular corymbose very slender-branched corymbose panicles which are pubescent or villous or sometimes glabrous below. Calyx subentire truncate or faintly 2-lipped cupular, about ·04–·05″ long only. Corolla segments 4 equal oblong obtuse, soon reflexed, throat white bearded. Drupe oblong or obovoid, ·14–·15″ or (*fide* Roxburgh, and when riper ?) round and the size of a pea, succulent, black.

Purneah, near the Nepal boundary ! Fl. May. Deciduous March–April.

Attains 1 ft. girth in our area with nearly smooth bark and rather hard cream-coloured blaze with deep yellow streaks. Leaves with obtuse or usually rounded base, the leaf-buds with a deciduous tomentum, mature in our area about 4–7″ by 1·7–3·2″, with scarcely any smell; sec. n. 4–7 very oblique, of which 2–3 from or from close to the base, nervules minutely reticulate, enclosing pale areoles beneath and with no visible glands. Petiole 1·2–1·7″, slender glabrous. Corolla ·08″, segments reflexed.

I assign all the sub-Himalayan specimens of *P. coriacea* to *P. scandens*, including *Hamilton's* specimen from Nathpur (quoted by *Clarke* under *P. coriacea* and *Wallich's P. ramosa*, No. 1774). It is significant that all the fruiting specimens are classed under *P. coriacea* at Kew, but the leaves being older are naturally more coriaceous.

2. **P. coriacea,** *Clarke.*

A huge woody climber with oblong, broadly oblong or ovate, caudate leaves 3–7·5″ long, rounded or cordate at the base, youngest only

slightly puberulous and with glistening evanescent glands, sec. n. 5–7, tertiaries and nervules very finely reticulate. Flowers very small white in strong-smelling pubescent corymbose panicles, 1·5–6″ diam. with brachiate branches. Bracts filiform, soon falling (and nearly always absent in herbarium specimens). Calyx cupular truncate. Corolla-tube ·1″ long with 4 reflexed oblong segments ·05″ long, throat bearded. Drupe ·2″, narrowly obovoid, 1-seeded.

Bonai, *Cooper*! Mayurbhanj, elev. 2000-3000 ft.! Fl. May. Fr. June. Dediduous, renewing leaves at time of flowering.

Blaze yellow, streaked orange-red. Old leaves coriaceous, caudation ·5–·9″, not as fine as in the last. Petiole 1·25–2″ long. Stamens far exserted.

I have kept this distinct in deference to *Clarke's* opinion, but the points of difference appear to me not sufficient even to constitute it a variety of *P. scandens* and can all be explained by age of the specimens and the different locality. The only doubtful point is the character of the ripe fruit in the two species. I have not seen fruit in the field and all herbarium specimens appear to have immature fruit.

3. **P. flavescens,** *Ham.* Syn. P. gmelinoides, *Haines* (*List. Cent. Prov.*)? Aria-Kasmar, *K.*; Buddhi-Kasmar, *S.*

A variable (if our varieties are the same species) large or small tree, sometimes mistaken for *Gmelina arborea*, with large ovate or elliptic or ovate oblong, acute or shortly acuminate, very sweet-smelling leaves 5–10″ by 2·5–7″, entire or (var.) coarsely toothed, densely or tomentosely pubescent (not stellate) beneath, and both surfaces dotted with minute yellow glands. Flowers ·1–·12″ long in closely pubescent or tomentose corymbose panicles, 5–7″ diam., with filiform bracts ·25–·75″. Calyx tubular-campanulate very shortly 2-lipped or mouth undulate, ·06–·07″, upper lip rounded entire, lower lip shortly 2-lobed or both lips rounded entire very short. Drupe globose, ·12–·2″, seated on the glandular and somewhat pubescent enlarged calyx, which then appears 2- irregularly 3–4-lobed. Endocarp longitudinally fluted or at base rugose.

Not uncommon in hilly tracts, especially near streams and on northern slopes. Singbhum! Palamau! Hazaribagh! Ranchi ghats! Santal Parganas! Angul! Fl. July. Fr. Aug.-Jan. Evergreen.

Trunk up to 4·5 ft. girth with light nearly smooth bark slightly flaking when old; blaze pale with yellow or brown streaks. Innovations tomentose. Twigs light-brown. L. often 3-nate on very young shoots, and often unequal when paired, pubescent on the nerves above with simple or forked hairs, base cordate or rounded, sec. n. 6–8 strong beneath, as also are the sub-parallel tertiaries which are often hidden by the indumentum. Petioles usually unequal, 1·25–5″, joined by a villous and glandular line. Corymbs short-peduncled. Corolla-tube exserted, ·08–·1″, lobes 4, oblong rounded subequal, nearly as long as tube, throat densely villous.

Var. **gmelinoides,** *Haines* (sp. *Fl. Cent. Prov.*). Leaves 7–12″ by 4–8″, usually ovate, cordate, coarsely-toothed, not closely pubescent beneath but nerves minutely pubescent. Flowers not seen. Fruit similar to above, *i. e.* with 4–3 cells and often a central lacuna (sometimes filled with tissue).

Rocky ravines in Palamau and Rajmahal Hills!

4. **P. integrifolia,** *L.* Ganiari, *Beng.*

A small tree or large shrub, more or less thorny on the trunk and larger branches, with oblong, oblong-obovate or oblong-ovate leaves 2–4″ long, shortly suddenly obtusely cuspidate and frequently crenate

towards the tip, glabrous, or youngest slightly pubescent beneath. Corymbs 1·5–3·5″ diam., minutely pubescent or sparsely strigose, with filiform or subulate small bracts ·1–·15″ long. Calyx glabrous or puberulous, sub-2-lipped toothed, one lip with 2, the other with 3 minute teeth or sub-entire. Corolla with 1 white and 3 green petals, ·1–·12″ long, throat villous.

Orissa, on ground periodically covered by the tide, Mahanadi delta! Fl. April-May. Fr. Aug.

Bark light-coloured. L. sometimes only 1-2″ (but this form not seen in our area), base rounded or obtuse, sec. n. 3–4 of which one from near the base. Petiole ·4–·5″. Corolla 2-lipped ·15″ long (with the lip), one lip oblong rounded longer than the other which has two rounded lobes, tube included. Drupe ·2″ seated on the patelliform calyx, endocarp slightly verrucose.

Gamble states that the wood is pleasantly scented, but not so aromatic as Sandal, of a light creamy brown moderately hard, even-grained. Wt. about 50 lbs.

5. **P. calycina,** *Haines. Kew Bulletin,* 1922, 3, p. 122. Syn. P. barbata, *F.B.I.,* in part.

A small, usually laxly spreading tree, with ovate-lanceolate or elliptic-oblong, more rarely ovate, obovate or lanceolate, always acuminate and more or less serrate or dentate leaves 4–8″ long by 2–4″ broad, glabrous or puberulous beneath or nerves persistently somewhat pubescent. Corymbs of small white flowers usually short-peduncled and under 3″ diam., puberulous or pubescent, with very small filiform few and caducous bracts. Calyx 2-lipped, ·08″ long, sparsely glandular, upper lip with 2 rounded sometimes imbricate lobes, lower lip with three shallow rounded lobes, sometimes obscure, in fruit calyx ·1″ very venose, often irregularly deeply split. Fruit globose ·1″, endocarp verrucose, 3–4-celled, 1–2-seeded.

Rajmahal Hills, common! Singbhum in ravines! Bonai, *Cooper*! Mayurbhanj! Puri! Angul, frequent! Fl. April-May. Fr. May–June. Evergreen.

Bark pale, on twigs yellow-brown, smooth; blaze white. L. usually quite glabrescent, always some on the tree toothed, base usually rounded or obtuse, usually 2–5 nerved at or near the base with 4–6 sec. n. above the basal each side, which are usually markedly decurrent on the midrib, tertiary nerves minutely reticulate; margin thickened. Petioles often unequal ·75–2·5″ long, pubescent on upper surface when young. Peduncles ·7–1·5″. Calyx often ciliolate, otherwise glabrous. Corolla ·25″ long, tube ·12″, lobes broadly oblong rounded subequal, upper lobe sometimes retuse, throat and base of lower lobe villous. Anther cells divaricate. Fruit 3–4-celled, 1–2-seeded.

The plant dries green.

6. **P. barbata,** *Wall.*

A small tree with pubescent shoots, oblong oblong-lanceolate or ovate-oblong, entire or very slightly serrate, acuminate or shortly acuminate leaves 3–6″ long, pubescent beneath, at least when young, and with small pubescent corymbs 1–3″ diam. Flowers ·15″ long. Calyx lobed half-way down or nearly to the base into 4 equal linear or oblong obtuse lobes, not enlarged, or lobes slightly broader in fruit, pubescent or glabrate. Drupe globose or pyriform, slightly rigid and verrucose.

Along the northern boundary only. Chiefly a tree of the lower Himalayas! Fl., Fr. May–June.

Leaves sometimes permanently pubescent beneath, base rounded or obtuse, sec. n. 3–5 of which 1 usually from base, nervules minutely reticulate. Petioles ·7–1·5″. Calyx ·04–·05″ long, lobes sometimes obtusely deltoid in fruit. Corolla-tube ·08–·09″, throat densely villous. Style arms more slender and acute than in *P. calycina.*

7. **P. latifolia,** *Roxb.* Gineri, *Nep.*, Sande-Sabar, *K.*; Dandra-sea, *S.*; Bakar, *H.*; Dankaroni, Gondhona, *Or.*

A low bushy tree with trunk up to 4 ft. girth, or shrubby with usually ovate, sometimes elliptic, leaves 2–6·5″ long, entire, pubescent beneath or both sides when young, and often permanently pubescent on the nerves beneath. Panicles 3-chotomous 2–5″ diam., hairy-pubescent, with short oblong or lanceolate bracts, or upper bracts very small linear. Calyx pubescent or strigose, 5-toothed, not or scarcely 2-lipped. Corolla distinctly 2-lipped, ·15–·2″ (including the lobes) long, upper lip oblong rounded entire or emarginate, lower longer with three spreading obtuse or rounded lobes. Drupe ·25″, depressed globose, seated on the saucer-shaped or patelliform ·2–·5 diam., sub-entire calyx.

Northern Champaran! Purneah! Rajmahal Hills, frequent on trap! Ranchi ghats! Hazaribagh! Manbhum, "a common bush" *Camp.*! Gangpur, along streams! Fl. April–May, on the new shoots. Fr. May–June.

Bark thin light-grey or brown; blaze white. Shoots pubescent. Leaves somewhat fœtidly aromatic (characteristic *Premna* smell), shining above, and both surfaces sometimes with minute erect hairs, sec. n. 4–8. Petiole ·25–·75 or rarely up to 1·5″ Cyme branches ascending, not branchiate. Cor.-tube exserted. Endocarp ridged or verrucose, 4-celled, usually 1-seeded.

It dries blue or black (exc. in var. **Gamblei**).

Var. **latifolia,** proper.

Roxburgh's plant, a native of the Coromandel coast, has the leaves orbicular-cordate or "oval," pointed or obtuse, about 2·5″ each way, a little downy, according to his description. He adds: "Bracts minute, falling. Fls. of a dirty yellow. Corolla upper lip 3-cleft, under one emarginate. Drupe the size of a pea, twin, juicy. Nut wrinkled, 4-celled. The leaves have a pretty strong though not disagreeable smell." A specimen in Herbarium marked "Hb. Roxb." has leaves rather densely pubescent beneath.

This form is perhaps not found in our area though the Rajmahal plant is a mere bush with the leaves rounded or shortly cuneate only at the base. The corymbs are very villous with brachiate branches and the bracts linear, sometimes persistent. A Puri specimen has small leaves with the tip sometimes obtuse, but the base is acute or rounded. The drupe is sometimes shortly cuspidate. This Puri form, also, has the leaves sometimes (not always in the same plant) slightly toothed. Our plants have all white flowers, though they may turn yellowish with age. It is not understood what *Roxburgh* means by the drupe being twin.

Var. **mucronata,** *Clarke.* Syn. P. mucronata, *Roxb.*

Leaves tapering both ends, entire, slightly villous beneath. The acumination is sometimes very fine and the leaves sometimes nearly or quite glabrous beneath.

Most of the north Indian forms are now usually called *P. mucronata* and it is common in our area. Purneah! Champaran! Gangpur! and possibly the Chota Nagpur plant; but specimens from Ranchi appear to come equally well under var. **cuneata**, *Clarke*, with leaf-base rhomboid or cuneate, calyx strigose, leaves often very pubescent when young. Some of these (var. **cuneata**?) have the leaves 4″ broad!

Var. **Gamblei,** *Haines.* Syn. P. integrifolia, *Gamble*, in *Darjeeling List*; Gineri, *Nep.*

A tree attaining 5 ft. girth, often with long straight thorns on young stems and branches. Bark dark grey, blaze soft, dead white. Twigs brown, brittle, younger pubescent. Leaves broadly lanceolate or elliptic 2·5–6″, acuminate and with cuneate base, drying green or

somewhat bluish, puberulous on midrib beneath when mature. Fruiting inflorescence as in *P. mucronata*, endocarp rigid, 4-celled and -seeded.

Northern Purneah, common ! Fr. Dec.

This may be a distinct species, but flowers are not available. There is even a little doubt as to whether the fruiting panicle belongs to the same tree as the green-drying one; although the tree from which it was taken was noted as thorny the specimen looks very like one of *mucronata* which has dried somewhat more green than usual.

8. **P. bengalensis,** *Clarke.*

A small tree with large narrowly elliptic to oblong or ovate acuminate leaves 4–9″ long by 2·5–6″ broad, closely stellately pubescent or tomentose beneath when young and thinly so when old. Flowers white or yellowish or greenish-white, ·12″ long, in large terminal panicles 6–8″ diam. Calyx distinctly 5-toothed but often 2-lipped with the upper lip 2-toothed, lower 3-toothed. Drupe globose or obovoid, ·17–·2″, endocarp smooth or slightly verrucose.

Tundi Hills, Manbhum. *Camp. Herb.*! Also common not far from Purneah, where it is also likely to be found. Fl. May-June. Fr. June-July.

Leaves with 7–12 strong sec. n. Petiole about 1″. Panicles not very dense, stellate-pubescent or tomentose, lowest bracts sometimes ·5″ linear-oblanceolate acuminate, upper ·12″ only. Throat of corolla with a row of hairs.

9. **P. tomentosa,** *Roxb.* Moria, *Or.*; Jhandakai, *Or.*

A small tree with the shoots, leaves and inflorescence densely clothed with a tawny-yellow stellate tomentum. Leaves 3·5–7″ (rarely up to 10″ by 6·5″ on coppice and pollard), ovate acuminate with obtuse cordate or sub-cordate base, mature stellate beneath and with minute glands between the hairs and with the characteristic *Premna* odour. Panicles pyramidal compact 2–4″ diam. with small greenish-yellow flowers. Calyx sub-globose tomentose, shortly equally 5-lobed. Drupe ovoid or sub-globose, ·2″ diam., endocarp smooth.

Puri district, Mendasal and Baruni-hill forests and common in the Mals ! Fl. March–April with the new leaves. Fr. May.

Bark light-brown. L. with 6–8 sec. n. of which 2 from the base, almost palminerved, tertiaries strong. Petiole 1–2″. Cor. 2-lipped, upper lip with 2 short rounded lobes, lower 3-lobed longer, pubescent and glandular outside. Ovary stellate-pubescent as well as the young fruit.

10. **P. herbacea,** *Roxb.* Ote-chamba, *K.*; Kada-met, *S.*

A curious little plant with herbaceous shoots 1–4″ high from a woody stock. Leaves usually closely appressed to the ground, sessile, obovate, 2–4″, sometimes 6″ by 4″, coarsely serrate and sometimes repand. Flowers very small white, in small corymbs 1·5″ diam. on a short peduncle. Drupe ·25″ diam.

On clay in open ground, fire lines, etc. Common probably throughout the whole area. Fl. May-June. Fr. June-July. The shoots are apparently annual and the new ones appear after the jungle or grass fires.

Leaves with 3–5 distant sec. n., reticulations large with a slender nervule to each tooth, teeth acute or rounded.

12. GMELINA, *L.*

Trees or shrubs with tomentose shoots and opposite leaves. Hairs often stellate. Flowers large yellow or brownish in small or panicled cymes with narrow bracts (large in *G. hystrix*, outside our area).

Calyx campanulate, shortly 5-toothed or subentire, unaltered in fruit. Corolla lipped with tube contracted below and slender ventricose above, and 5- (4-) lobed limb. Stamens didynamous, subexserted, anther-cells oblong pendulous. Ovary 4-celled, with slender style and shortly 2-fid stigma. Ovules 1 in each cell. Drupe succulent with hard 4–2-celled endocarp which opens by small caps on germination of the seed. Seeds oblong.

Seedling with oblong fleshy cotyledons.

Arboreous. Leaves large ovate . . . . . 1. *arborea.*
Shrubby. Leaves under 2″. Often thorny . . . . . 2. *asiatica.*

1. **G. arborea,** *Roxb.* Kasmar, *K., S.*; Gambhar, Gamhari, *H.*; Kumar, *Or.*

A large or mod.-sized tree with broadly ovate acuminate or caudate, usually cordate leaves 4–9″ by 2·5–8″ usually glaucous beneath with petioles 2–6″ long, often unequal in a pair. Flowers 1–1·5″ long, reddish or brown and yellow in lateral or terminal panicles 3–8″ (or attaining 12″, *F.B.I.*) long. Drupe obovoid ·75–1″ diam., usually 2-1-celled and -seeded.

Throughout the whole province, esp. on the cool sides of hills, but nowhere very abundant. Fl. Feb.–April, when more or less leafless. Fr. May–June.

Bark light-grey exfoliating in lighter coloured patches when old; blaze thick, a chlorophyll layer just under the outer bark, then pale yellow, white inside. L. (in the type) stellately-hairy beneath (teste *C. B. Clarke*),* base strongly 3–5-nerved and usually shortly cuneate on the petiole, some or all with one or several large glands at the base between the primary nerves; sec. n. 4–6 above the basal, tertiaries more or less parallel. Panicles tomentosely yellow-hairy with subulate caducous bracts ·2–·3″ long. Calyx ·2–·25″, campanulate. Corolla tomentosely-hairy outside up to 2″ on the long diameter, upper lip much shorter than the lower, anterior lobe shovel-shaped.

The first leaves on the seedling are strongly toothed and such toothed leaves are sometimes found on mature plants.

Var. *α* **glaucescens,** *Clarke* (*F.B.I.*).

L. 6–10″ glabrous and glaucous beneath, the glaucous appearance being due to dense microscopic glands or scales, which are hidden in the pubescent forms. Tertiary nerves not raised or only slightly raised. Panicle usually large.

Throughout its distribution and commoner than the type in our area! Indeed I believe the type is only found in the extreme north of the province, if at all.

Var. *β* **canescens,** *Haines* (*Fl. Ch. Nag.*).

L. 3–6″ subcoriaceous, grey-pubescent beneath with simple not stellate hairs. Tertiary nerves strongly raised beneath. Panicle 3–4″, strict.

Santal Parganas!

The wood is largely used for making drums. It is white, easily worked and does not warp or shrink. It should be more widely propagated. *Roxburgh* says that it is very durable under water and in general stands the weather well. *Gamble* says that it is highly esteemed for planking, furniture, door-panels, etc. He gives the weight as about 35 lbs. The average of 6 trees sown by me was 42 ft. 8″ in height and 2 ft. 9·9″ girth after 16 years, and *Gamble* says that his specimens show about 4 rings per inch of radius, so that growth is very fast.

Cattle and deer are very fond of the fruit and deer also browse the shoots.

The fruit is said to be sweetish-bitter and cooling and the root as bitter, tonic and stomachic and useful in fever and indigestion. *Dutt.*

* *Fl. Br. Ind.*, iv, p. 581. I have not seen the type, and *Roxburgh* merely says hoary beneath in *Flora Indica* without allusion to stellate hairs.

2. **G. asiatica,** *L.* Nag-phul, *H.*

A large shrub, with yellow, often spinescent, branchlets, small ovate to obovate or rhomboid entire or usually lobed obtuse leaves ·5–1·5″ long, cuneate on a slender petiole, and yellow flowers 1·5″ long in short tomentose racemes 1–2″ long. Drupe ·75″ ovoid or obovoid, 2-seeded.

Wild or, probably, escaped on the sandstones near Rairakhol, not far from the town! Often grown in gardens. Fl. April-June.

Leaves in the Rairakhol plant somewhat fleshy. Calyx and corolla with small glistening glands as well as somewhat pubescent.

13. CLERODENDRON, *L.*

Trees or shrubs, sometimes rambling, or subherbaceous, with opposite or 3-nate, often palminerved and glandular, simple leaves and large or mod.-sized usually showy flowers in axillary or terminal panicled cymes. Calyx campanulate, persistent, often accrescent and brilliantly coloured in fruit. Corolla zygomorphic with a slender usually filiform tube and a more or less oblique 5-fid spreading limb. Stamens 4, exserted. Ovary imperfectly 4-celled. Fruit usually a succulent, more rarely nearly dry, drupe, frequently depressed and 4-grooved, separating into 1–4 pyrenes or drupels.

I. Corolla-tube under 2″ long :
  A. Straggling subscandent shrubs with white flowers :—
    L. obovate rounded fleshy. Calyx ·1–·2″ in flower . . 1. *inerme.*
    L. ovate or rhomboid. Calyx ·3″ in flower . . . . 2. *phlomidis.*
  B. Compact or rigid shrubs or undershrubs :—
    1. Panicle large spreading, usually red in fruit. Leaves broadly ovate, usually cordate. Calyx deeply lobed :—
      Corolla white with pink. L. 4–8″ . . . . . 3. *infortunatum.*
      Corolla scarlet. L. 6–12″ . . . . . 4. *squamatum.*
    2. Panicle narrow. Leaves narrow. Calyx very shallowly lobed. Fls. usually blue . . . . . 5. *serratum.*
II. Corolla-tube 3″ and over :—
  L. narrow, usually whorled. Fls. white . . . . . 6. *siphonanthus.*

Besides the above there are several species of *Clerodendron* commonly grown in gardens. One of these, *C. Thomsoni*, is a climber with pure white calyx and crimson corolla.

1. **C. inerme,** *Gaertn.*

A straggling shrub, with a very strong rutaceous odour from the numerous glands, with grey very lenticellate, patent, minutely closely pubescent twigs. Leaves ·75–1·5″ elliptic or obovate with rounded or retuse tip and cuneate base, glabrous, closely punctulate with glands beneath. Flowers white with bright red filaments, mostly in axillary 3-flowered cymes from the uppermost leaves. Corolla-tube slender 1″ long. Drupe pyriform ·5″ by ·4″, somewhat 4-grooved, base embraced by the accrescent calyx.

Near the sea, from Balasore! to Puri! Fl. April and Dec. (perhaps Dec.–April). Fr. Dec. and old fruits found in April, mostly insect-punctured and oblique. Evergreen.

Leaves somewhat fleshy, young minutely pubescent. Petiole ·15–·2″. Peduncles ·5–·75″, sometimes up to 7-fld. Calyx ·1–·2″ in flower with 5 short equal triangular teeth, enlarging to ·25″ or ·3″ in fruit with a thickened pedicel. Cor.-lobes ·25″ oblong. Drupe ultimately hard and splitting into 3–4 pyrenes.

2. **C. phlomidis,** *L.f.* Syn. C. phlomoides, *Willd.*; Panjot, *S.*; Urni, *H.*; Donkari, *Or.*

A large, often rambling shrub, with a close short hoary pubescence on the branchlets, broadly ovate or sub-rhomboid entire or coarsely crenate-dentate leaves usually about 2″ by 1·5″, and axillary and terminal cymose panicles of white flowers with tube ·75–1″ long and limb ·75″ diam. Calyx campanulate ·3″ long in flower with triangular caudate acuminate lobes, slightly enlarged in fruit. Drupe broadly obovoid depressed, ultimately nearly dry ·3–·5″ separating into 4 pyrenes.

Usually in hedges and near villages, but doubtfully indigenous. Singbhum! Palamau! Santal Parg.! Angul! Narsingpur! Often seen in gardens all over the province. Fl. Sept.–March and perhaps at other times. Evergreen.

L. attain 3·5″ each way below, but very small ones occur on and near the panicle; young puberulous both sides, quite mature glabrous or nearly so, acute or sub-acuminate; sec. n. 4–5, of which one from the base. Petiole slender ·5–1″. Cymes 1·5–3″, each 3–12-fld., but often the whole top of the branch converted into a large leafy panicle. Calyx green or purplish, lobed half-way down. Cor. glandular-pubescent, fragrant at night.

It is given to cattle for diarrhœa and worms. The fruit of this is also frequently insect-punctured, which converts it into an oblong fleshy mass closely invested by the (then) marcescent glandular-pubescent corolla.

3. **C. infortunatum,** *Gaertn.* Bhant, *Th.*; Kula-marsal, Chamgar, *Ho.*; Barni, Varni, *S.*; Gokhol, *Kharw.*; Bhant, *H., Beng.*; Anguti, Kunti, *Or.*; Komuti, *Khond.*; Bania-ganta (Mayurbhanj).

A robust shrub or undershrub 4–6 ft. high with densely fulvous-hairy branches, large ovate and usually cordate leaves 4–8″ long and broad, and large terminal subcorymbose panicles of white and pink or pink-spotted flowers on their cymose branches. Conspicuous in fruit from its large red accrescent calyces, and often reddening panicles. Drupe bluish-black, at first enclosed by the calyx, which, however, opens widely towards maturity.

In all the districts, especially the moister ones. Along streams and in shady places and edges of glades in the forest in the drier ones. Champaran, common! Purneah, common! Muzaffarpur! Chota Nagpur, often gregarious in the places indicated! Puri! Athmallik! Angul, common! Sambalpur! Fl. Feb.–May. Fr. May–July.

Occasionally attains 10 ft. L. persistently hairy, entire or dentate, with numerous minute glistening glands beneath; sec. n. very strong, 5–7, of which one strong, and often also one weaker one, from the base. Petiole 1–4″. Panicle tomentosely hairy, often leafy below. Calyx ·4–·5″ long in flower, 5-fid, with acuminate lobes, 1·25–1·5″ diam. in fruit. Cor.-tube ·7–·75″ long, rather slender, pubescent; lobes ·5–·6″, one posterior and the other 4 declinate or obliquely spreading. Stamens 1·5–2″ long (their changes in position with regard to the style very well marked in this species). Style unbranched. Fruit usually of a single globose drupel ·25–·3″ diam., finally black.

The flowers are scented in the evening. The leaves warmed with ghee are applied to the head for catarrhal colds.

4. **C. squamatum,** *Vahl.*

A very beautiful shrub when in full flower, 2–4 ft. high, with rich green roundly ovate and cordate leaves 6–12″ long and broad, and large terminal panicles of which every part is scarlet. Corolla-tube ·75–1″ very slender, lobes ·3–·5″. Drupe ·3–·5″ diam. blue-black, seated on the enlarged fruiting calyx which is very broad, ·7–1·5″ diam.

Found wild close to our area in the lower hills and Terai and frequently seen in gardens. Fl., Fr. April–Aug.

Leaves spinulosely-denticulate with petioles up to 1 ft. long. Calyx nearly ·5″ in flower, 5-fid or -partite. Corolla brilliant scarlet.

5. **C. serratum,** *Spreng.* Barangi, *H.*; Sarom-lutur (Sambhar's-Ear), *S.*

An irregularly branched perennial shrub, or, in areas annually burnt, with tall straight subherbaceous stems 3–6 ft. high from a perennial stock. Leaves opposite or 3-nate, subsessile, linear-oblong to elliptic, obovate or oblanceolate, coarsely serrate leaves 3–6″ long. Flowers over 1″ diam. blue or sometimes pale pink or white on the lateral cymose branches of large terminal pubescent panicles with persistent ovate, obovate or lanceolate bracts. Calyx campanulate ·2″, pubescent, lobes 5 very shallow; slightly enlarged in fruit. Cor.-tube ·25–·3″ (–·5″, *F.B.I.*). Drupe of 1–3 (rarely more) succulent connate drupels. ·15–·2″ long, each drupel about ·15–·2″ diam.

Throughout the province, more especially in damp places in the moister districts. Grass tracts of Purneah, common! Santal Par.! Chota Nagpur, chiefly in valleys and shady slopes, not very common, but general, more frequent at about 2-3000 ft.! Fl., Fr. r.s. to Nov. or April–Nov.

Branches 4-angled above. Leaves often very fleshy especially in unburnt plants, whitish beneath, glabrous or very nearly so, somewhat fœtid in smell. Petioles ·1–·3″. Whole panicle sometimes coloured pink, sub-pyramidal (in the sub-Himalayan forms) or narrowly oblong. Lower lip of corolla usually deeper-coloured than upper, ·75″ long with a large nectary at base, mouth very oblique and constricted. Stamens very long and declinate, bluish.

Root given in fever and also used in the fermentation of rice-beer in the Santal Parganas.

6. **C. siphonanthus,** *Br.* Bharangi, *H.*; Bamanhati, *Beng.*

Shrubby, or herbaceous with tall annual strict hollow stems 3–6 ft. high. Leaves 3–5-nately whorled, rarely opposite, narrowly lanceolate or linear, rarely elliptic or oblanceolate, 5–8″ long by usually ·5–1·5″ broad only, glabrous, entire or sinuate, rarely sparsely coarsely toothed above. Flowers pretty, white or cream in axillary cymes and forming a large terminal panicle easily distinguished by the very long slender tube of the corolla, which is 3–4·5″ in length. Drupe blue of 1–4 connate drupels, each about ·35″ long and ·25″ diam., seated on the large red accrescent calyx.

In grass tracts and near watercourses, especially in the moister districts. Champaran! Purneah, common! Santal Parganas! Singbhum! Ranchi! Palamau! Fl. June–Aug. Fr. Aug.–Dec.

Occasionally attains 20 ft. when not burnt with stems 1 ft. girth (as in the compound of Litipara Rest House, Santal P.!). L. with tapering base, sessile or subsessile, with 6-10 oblique fine sec. n. Panicle usually narrow, lateral cymes few-fld. Bracts linear or linear-lanceolate, ·5″. Calyx ·5″ in flower, 1·3″ in fruit, cut more than half way down into lanceolate acute segments.

The root is considered useful in asthma, cough and scrophulous affections. *Dutt.*

14. HOLMSKIOLDIA, *Retz.*

Shrubs (scandent in our species) with opposite leaves and showy flowers in short axillary cymes with small bracts. Calyx broadly obconic or sub-patelliform, membranous, coloured, with entire or subentire margins. Corolla with curved tube and oblique limb with 5

short lobes. Stamens didynamous exserted, anther-cells ovate parallel. Ovary of 2 2-celled carpels, each cell with one lateral ovule (as in *Clerodendron*). Fruit drupaceous included in the contracted base of the accrescent calyx, depressed 4-lobed nearly half-way down, separating into 4–1 pyrenes.

1. **H. sanguinea,** *Retz.* Jhimbria, *S.*

A large climbing or rambling shrub with angular drooping branches, ovate crenate-serrate or sub-entire leaves 2–6″ long by 1·25–3·5″ broad. Very handsome when in flower. Cymes very numerous and often panicled at the ends of some of the branches. Calyx orange or scarlet, patelliform or somewhat oblique, very venose, ·6–·75″ diam. in flower and 1″ in fruit. Corolla scarlet tubular curved ·75–1″ long.

Champaran! Purneah! Rocky ravines in Bandgaon and Porahat! Ranchi (Pitorea Hill, *Wood*)! Manbhum, *Campbell*! Hazaribagh, chiefly on the ghats! and on Parasnath, *Camp.* Fl. Nov.-Jan. Sometimes seen in gardens.

Leaves puberulous and pubescent on the nerves beneath, minutely glandular beneath, base rounded or cordate, acuminate; sec. n. 3-5. Petiole ·5–2″. Drupe ·25–·3″.

15. CARYOPTERIS, *Bunge.*

Small trees or shrubs with opposite toothed or sub-entire leaves minutely glandular beneath. Flowers often showy in small dense many-fld. cymes with small bracts, sometimes running into thyrsiform panicles at the ends of the branches. Calyx deeply 5-fid, segments triangular or lanceolate. Corolla-tube short cylindric, limb zygomorphic with anterior lobe largest (often crisped or fimbriate in non-indigenous species). Stamens didynamous exserted, anther-cells divaricate, confluent above. Ovary of 2 2-celled carpels, or 1-celled above, with two placentæ with incurved margins, each bearing a lateral pendulous ovule with thickened funicle. Fruit small globose, capsular, separating into 4 pyrenes (or valves with more or less inflexed margins),* each pyrene or valve with 1 seed.

1. **C. Wallichiana,** *Schauer.*

A large laxly branched shrub or sometimes a small tree with 4-angled subtomentose shoots and lanceolate serrate or sub-entire leaves 2–4″ long with numerous yellow glistening glands beneath. Flowers blue or light purple in small cymes crowded into thyrsiform elongated panicles. Calyx ·1–·17″ in flower, ·2–·25″ in fruit, densely pubescent, with linear-lanceolate lobes. Corolla with tube ·25″ long pubescent above, midlobe of lower lip ·3″, blue, other lobes about ·25″, paler. Capsule ·15–·17″ diam., pubescent.

Northern Champaran, frequent! Palamau, river banks in the hills, rare! Santal Parg., *Gamble* (in *S.P.* list). Fl. Dec.–April. Fr. April.

Bark brown in long narrow strips. L. acuminate, base cuneate, ashy pubescent beneath. Petiole ·3″. Cymes very short, pubescent, lateral, the shoot growing through the thyrse and leaving them distinctly axillary.

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* I am not quite clear on the fruit structure. From my specimen the valves appear quite closed by a coriaceous wall on the inner two sides and each to inclose a seed, but the *Nat. Pflanz. Fam.* states that the margins are infolded and inclose a stone (pyrene). The *F.B.I.* states that the edges are incurved and enclose a seed. The *Fl. C. N.*, probably founded on a field-note, says the valves embrace a slightly winged pyrene, thus agreeing with the *Nat. Pflanz. Fam.*

16. SYMPHOREMA, *Roxb.*

Rambling or scandent shrubs with leaves opposite (or floral sub-whorled), entire or toothed. Flowers small white, nearly regular in involucrate capitate cymes; involucre of 6 oblong or foliaceous bracts. Calyx obovoid, 4–8-toothed, somewhat accrescent. Corolla with cylindric tube and 6–16 subequal narrowly oblong lobes. Stamens as many as the corolla-lobes, exserted, anthers ovate with parallel cells. Ovary of 2, deeply divided, more or less 2-celled carpels, each cell with one apical pendulous almost orthotropous ovule. Fruit nearly dry, included in the calyx, 1-seeded. Embryo fleshy with somewhat concave cotyledons.

Corolla and stamens 12–16 merous. Floral l. ell.-obovate . . 1. *polyandrum*.
Corolla and stamens 6–8-merous. Floral l. lanceolate . . . 2. *involucratum*.

1. S. polyandrum, *Wight.* Badichand, *Or.*

A large scandent or subscandent shrub with ovate, sub-orbicular or broadly elliptic leaves mostly 4–5″ long, repand or coarsely toothed, villosely tomentose beneath. Easily recognised in flower by its pseudo-whorls of grey involucral leaves 1–1·5″ long surrounding the contracted cyme of delicate white flowers. Calyx ·25–·4″ long, rather larger in fruit. Corolla 12–16-partite with an equal number of exserted stamens.

Dry Sal forests in Singbhum! Bonai, *Grieve*! Narsingpur! Sambalpur! Angul! Kalahandi! Fl. March–April when it is more or less deciduous.

Shoots very closely grey-stellate-tomentose. L. attaining 8–9″ by 4″ with usually a rounded or very obtuse base, sec. n. 3–4 of which 1 is close to the base. Petioles ·5–·75″. Involl. bracts elliptic-obovate or obovate, often toothed above. Fruit included in the ·5″ long calyx.

2. S. involucratum, *Roxb.*

Similar to the last in habit, with ovate or rhomboidly-elliptic leaves 3–5″ long, less densely tomentose beneath and sometimes quickly sub-glabrescent, acute or acuminate. Involucral bracts about 6, ·25–·9″ long, oblanceolate membranous. Calyx ·2″ long, tubular, about 8-toothed. Corolla and stamens 6–8-merous.

In dry rocky places and dry forests (but usually in the damper districts!) Monghyr Hills, *Ham.*; Angul, Bhurkundi forest! Narsingpur, on the ghats, mixed with *S. polyandrum*! Puri! Fl., Fr. with the last and like it, deciduous.

Bark pale, lenticellate. L. usually narrower and more acute and less tomentose compared with *S. polyandrum*, base often cuneate. Cymes mostly 7-flowered, but appearing much smaller from the less panicled cymes and the smaller bracts, which are usually only ·25–·4″ in flower, enlarging in fruit to 1″ or more.

17. AVICENNIA, *L.*

Shrubs or small trees with coriaceous opposite entire leaves and small sessile subregular flowers (yellow in our species) in capitate or contracted peduncled cymes, sometimes forming terminal 3-chotomous panicles. Bracts small. Calyx 5-partite, not accrescent, segments more or less ovate, imbricate. Corolla with short cylindric or campanulate tube and spreading 5–4-lobed limb. Stamens 4, on the corolla-throat, shortly exserted, ovate. Ovary of 2 carpels, 4-celled or 2-celled, below with a central 4-angled or -winged column, free above. Ovules 4, orthotropous, pendulous from the apex of the column between the wings. Fruit a compressed somewhat succulent

capsule, dehiscing by 2 valves. Seed 1. Embryo with plicate cotyledons and hairy radicle.

Shrub or small tree. Leaves acute or acuminate. Capsule less than 1″ long. Stamens included. Style short or 0 . . . . . 1. *alba*.
Small tree. Leaves very obtuse. Stamens included. Capsule 1″ or more. Style long . . . . . 2. *officinalis*.

1. A. alba, *Blume*. Bani, *Or.*; Safed Bani (the tree form), *Or.*

A large shrub or a tree up to 3 ft. girth, with lanceolate leaves, white beneath, 2–3″ or up to 5·5″ long, acute (tree) or long acuminate (shrub). Flowers yellow ·2″ diam. in contracted cymose panicles 1–2″ long. Sepals nearly free, ell.-oblong to obovate, rounded, ·1–·12″. Corolla ·18″ long, pubescent outside, tube half as long as the ovate-lanceolate lobes. Stamens shorter than the corolla-lobes. Ovary oblong, woolly at the tip, style 0, stigma of 2 triangular lobes. Young fruit lanceolar, ·75″ long, tomentose.

Tidal forests of the Mahanadi delta! Fl. May. Fr. Aug.–Sept.
The tree form looks to me a distinct species, but I have not found it in flower (in itself significant as the shrub was in flower), the leaves are more elliptic, not long acuminate, often only acute, the petioles less markedly articulate at base. The bark is white with white blaze as in next.

2. A. officinalis, *L.* Kala Bani, *Or.*

A large tree with oblong or elliptic or obovate leaves with very rounded tip 2–5″ long, white beneath, base acute or subobtuse, midrib dark, sec. n. fine rather irregular, 7–10, very reticulate between, large glands sometimes at the apex of petiole, petiole ·4–·8″ long. Flowers yellow in axillary and terminal peduncled 3-chotomous panicles 2–3·5″ long, in bud with numerous imbricating bracts, which are elliptic rounded and white ciliate but glabrous and shining on back, in strong contrast to the white branches of the panicle. Fruit opaque green, wrinkled, especially at the base, ovoid, 1·3″ long, with large fleshy cotyledons. Hypocotyl densely fulvous hairy.

In the mangrove swamps of the Mahanadi delta, common! Fl. June–July. Fr. Aug. Also often germinates on the tree in August; the hypocotyl densely fulvous-hairy.
Bark smooth pale grey. Blaze very white. Shoots white-tomentose. The leaves less white beneath than in *A. alba*, with which however no confusion is possible.

FAM. 106. LABIATÆ.

Herbs or undershrubs, rarely shrubs, usually with sweet or aromatic smell due to ethereal oils, which are secreted in several different forms of glandular hairs often sunk in small pits in the epidermis and in the leaf often giving rise to translucent dots. Stems very often 4-angular or 4-sided (with rounded corners). Leaves opposite and decussate or sometimes whorled, simple or very rarely pinnatisect (*Lavandula*), exstipulate. Flowers more or less zygomorphic, often evidently 2-lipped, often small, solitary or in contracted cymes in the axils of leaves or bracts forming false "whorls," which sometimes are crowded into heads or spikes, rarely cymes effuse. Calyx more or less tubular, persistent. Corolla with tubular base and 4–5 subequal lobes or 2-lipped, lobes imbricate in bud. Stamens inserted in the corolla-tube,

2 or 4 perfect, subequal or didynamous; anther-cells sometimes confluent. Disc prominent, often irregular. Ovary free 4-lobed or 4-partite, consisting of 2, 2-celled and -lobed carpels, style arising from between the lobes, 2-fid or one arm suppressed. Ovules 1 in each cell, erect, anatropous. Fruit of 4 dry (rarely fleshy in genera outside our area) indehiscent "nutlets" attached by a small basal or oblique or a larger ventral areole. Seeds erect, albumen scanty or 0, radicle inferior.

I. Ovary 4-partite with gynobasic style. Nutlets with small basal or dorso-basal areole (Genera 1–23):—
  A. Stamens 4 declinate (lying on the lower lip or enclosed by it); anther-cells confluent (Genera 1–9):—
    1. Disc lobes, if developed, alternating with ovary lobes. Areole very small, basal:—
      a. Anterior corolla-lobe scarcely longer than posterior, neither deeply concave nor constricted at base:—
        i. Posterior calyx-lobe broader than the others, decurrent on the tube and enlarged in fruit:—
          Style with 2 equal subulate lobes. Cor.-tube included or only slightly exserted . . . 1. *Ocimum.*
          Style undivided, often clavate. Corolla-tube exserted . . . . . 2. *Orthosiphon.*
        ii. Posterior calyx-lobe larger than the others but not decurrent on the tube:—
          Whorls in terminal spikes. Fruiting calyx transversely ribbed or pitted . . . . . 3. *Geniosporum.*
          Fls. in small terminal heads. Fruiting-calyx with gibbous base not transversely ribbed nor pitted . . . . . 4. *Acrocephalus.*
      b. Anterior corolla-lobe deeply concave in front or constricted at base:—
        i. Anterior lip of corolla elongated, not sharply deflexed:—
          * Filaments free:—
            Calyx mouth oblique, upper lip usually deflexed over the mouth in fruit. Fls. in dense spikes . . . . . 5. *Anisochilus.*
            Calyx 2-lipped or 5-toothed. Fls. in whorls or lax cymes . . . . . 6. *Plectranthus.*
          ** Filaments connate below. Whorls usually distinct . . . . . 7. *Coleus.*
        ii. Anterior lip of corolla short, sharply deflexed . 8. *Hyptis.*
    2. Disc-lobes opposite to ovary-lobes. Stamens included. Areole small, dorso-basally oblique . . . . 9. *Lavandula.*
  B. Stamens not declinate, anther-cells 1–2 (Genera 10–23):—
    1. Stamens suberect, diverging and distant. Cor.-lobes flat:—
      a. Anthers subglobose, 1-celled, widely expanded after shedding pollen. Cor. subequally 4-fid or lower lobe larger:—
        i. Calyx 5-toothed, lobes not plumose. Filaments bearded:—
          Inflorescence of panicled sub-capitate cymes. Calyx tubular-ovoid. Corolla sub-2-lipped . 10. *Pogostemon.*
          Infl. spicate. Calyx minute ovoid. Cor. subequally 4-fid . . . . . 11. *Dysophylla.*
        ii. Calyx 5-fid, segments finally plumose. Shrub . 12. *Colebrookia.*
      b. Anthers 2-celled, at least when young. Corolla often weakly 2-lipped. Filaments not bearded:—
        Fls. minute, spicate. Corolla 4-lobed, sub-2-lipped 13. *Elsholtzia.*
        Fls. small, whorls axillary or spiked. Calyx campanulate 5-toothed. Corolla subequally 4-lobed . *Mentha* (p. 741).
        Fls. small, racemed. Calyx 2-lipped. Corolla-lobes 5 14. *Perilla.*

2. Stamens ascending, usually in unequal pairs. Anther-cells distinct. Corolla lipped:—
   a. Corolla-lobes flat, small. Calyx mostly 13-nerved:—
      Calyx 5-toothed, regular . . . . . 15. *Micromeria.*
      Calyx distinctly 2-lipped, one lip 2- the other 3-toothed . . . . . 16. *Calamintha.*
   b. Upper corolla-lip erect, concave or hooded, lower spreading:—
      i. Perfect stamens 2, connectives slender, jointed on the filament . . . . . 17. *Salvia.*
      ii. Perfect stamens 4, didynamous:—
         * Posterior pair of stamens longer.† Upper lip not galeate:—
            Anthers all 2-celled, cells diverging . . 18. *Nepeta.*
            Upper pair of stamens with 1-celled anthers . 19. *Anisomeles.*†
         ** Anterior pair of stamens longer, ascending under the galeate upper lip:—
            ! Anterior pair of stamens with 1-celled anthers:—
               Calyx 2-lipped, closed after flowering, upper with a broad plate . . . . . 20. *Scutellaria.*
            !! Both pairs of stamens with 2-celled anthers. Upper (galeate) corolla-lip pubescent or villous (*Lamieæ*):—
               Leaves deeply cut. Calyx teeth 5 spinescent 21. *Leonurus.*
               Calyx 8-10-toothed. Lower cor.-lip large. Fls. white . . . . . 22. *Leucas.*
               Calyx 8-10-toothed. Lower cor.-lip small. Fls. red . . . . . 23. *Leonotis.*

II. Ovary 4-lobed, style not gynobasic. Nutlets with a large oblique or ventral areole. Upper cor.-lip not galeate:—
   All corolla-lobes combined into a large lower lip and stamens ascending exserted. Nutlets minute . . . 24. *Teucrium.*
   Corolla with short 2-lobed upper lip and lower large 3-lobed spreading lip. Nutlets up to ·1″ long . . . . . 25. *Ajuga.*

1. OCIMUM, *L.*

Herbs or undershrubs with the leaves copiously pitted with minute glands yielding a strong, usually very sweet smell. Fls. purple or white in 6–10-fld. whorls in terminal spikes or racemes, tips of the pedicels recurved, bracts small or minute. Calyx 10-nerved with a broad upper lobe, the two lowest teeth acuminate or sub-aristate. Corolla with short tube, not annulate within, upper lip subequally 4-fid, lower hardly longer, declinate entire. Stamens 4, declinate, exserted, filaments naked or upper toothed or hairy below, anther-cells confluent. Style long with 2 subequal slender stigmas. Disc entire or lobed. Nutlets smooth or sub-rugose, more or less mucilaginous when moistened.

I. Shrubby. L. 2–4″. Lower calyx-teeth shorter than upper lip. 1. *gratissimum.*
II. Herbaceous or only slightly woody below. Leaves rarely 2″. Lower calyx-teeth longer than the upper lip:—
   A. Pedicels shorter than the calyx:—
      Corolla ·3–·5″ . . . . . 2. *basilicum.*
      Corolla ·17″ . . . . . 3. *canum.*
   B. Pedicels mostly longer than the calyx . . . . . 4. *sanctum.*

† All works consulted, following *Bentham*, place *Anisomeles* under the "Lamieæ" with the characteristic "lower pair of stamens longest" without remark. In 1893 I noted in Bengal specimens that the posterior pair are the longer and I have repeatedly confirmed this observation in other districts.

1. O. gratissimum, *L.*

An undershrub 2–4 ft. high with very woody base (sometimes attains 8 ft. in other provinces) and a very sweetly aromatic smell. Leaves 3–4·5″ below, ovate, decurrent on the long petiole. Flowers white inconspicuous, whorled in racemes 4–5″ long with pedicels about half as long as the calyx and lanceolate-acuminate shortly stipitate bracts. Calyx pubescent outside, glabrous inside. Filaments bearded at the base.

Waste ground near villages and doubtfully indigenous. Hazaribagh, on a shoulder of Parasnath! Santal Parg.! Angul! Fl. Oct.–Dec. Fr. March.

L. coarsely crenate or crenate-serrate, acute, sparsely hairy on the nerves beneath and slightly shortly pubescent with hyaline hairs on midrib above. Lower petioles 1·5″. Racemes densely pubescent. Calyx with the upper lip much longer than the lower, upper lobe ·12″ (from base) in flower, large broad obovate obtuse, ·2″ in fruit; lateral lobes with an obtuse tooth and lower mucronate tooth; lower lip with 2 very small mucronate teeth shorter than the lateral. Corolla barely exserted, upper lip ·05″, lower slightly saccate and slightly acuminate. Nutlets subglobose red-brown, ·05″ diam., with oblong basal scar, minutely verrucose.

2. O. basilicum, *L.* Lo:–ba, *Ho.*

An erect, much branched, strongly scented herb 8–18″ high, less slender and usually more branched from the base than *O. canum*, with pubescent stems hairy at the nodes, usually ovate, entire or cut, glandular leaves 1–3″ long and white or pale-purple flowers in numerous close racemes, the large patellate upper calyx lobe becoming horizontal in fruit from the deflection of the pedicel. Lower two calyx teeth sub-aristate, longer than the upper lip. Corolla ·3″ long or more, lower lip usually white or rose, longer than the 4-lobed upper lip. Bracts petioled. Pedicels about ·12″ long.

Chiefly in cultivated ground. Patna to Monghyr, *T.T.*! Bihar, *Hope*! Gya, *Prain*! S.P.! Chota Nagpur, frequent! Probably throughout the province. Fl., Fr. c.s.

The plant is very variable. The leaves in some cases are exactly like those of *O. canum*. In var. **difforme** they are deeply cut; in var. **thyrsiflora** they are larger and attain nearly 3″, are distinctly serrate and have longer petioles. In general the leaves are about 1–1·5″ long only, with slender petiole ·2–·3″ The racemes are often 6″ long with the whorls usually closer (scarcely ·25″ apart) than in *O. canum*, the fruiting calyces ·18″ diam., often contiguous all round the axis, upper calyx-lip ciliate, dorsally glabrous, few long hairs at base, 3-ribbed and very venose in fruit, sides lobe ovate mucronate. Two filaments villous at base Nutlets ·07″ oblong, slightly glandular, otherwise smooth, black.

3. O. canum, *Sims.* Lo:–ba, *Ho.*

Erect slender herbaceous and often strict 12–20″ high; 4-angled stems densely pubescent upwards and sometimes almost villous. Leaves elliptic or usually ell.-lanceolate or rhomboid, 1–1·7″ by ·4–·7″, entire or shallowly serrate with long slender sparsely pilose petioles. Flowers about 6 in a whorl in terminal elongating racemes 2–4″ rarely elongating to 8″ in fruit, the short pedicels erect and often closely appressed to the rhachis so that the flowers on their decurved tips appears sessile. Calyx densely villose inside, pilose or villose below with spreading hairs outside, ·07–·14″ measured along upper lip, ·1–·17″ along lower lip. Corolla ·14–·17″ long or sometimes up to ·25″ long, white or pale-purple with tube ·05–·1″. Filaments

glabrous, anterior on throat much exserted, upper sometimes with a tooth at base. Nutlets oblong-ellipsoid, black when quite ripe, 0·5″.

Common, especially near cultivation. Singbhum! Ranchi! Manbhum, *Camp.*! Angul! No doubt throughout the province. Fl., Fr. Aug.–March. Annual.

Leaves very thin when dry, with the numerous glands sunk on the under surface, glabrous or with a few long villi on the nerves; base tapering. Petiole ·2–·75″. Pedicels ·06–·07″, erect, pubescent. Upper calyx-lobe ·1–·15″ each way in fruit, glabrous above on the back, teeth of lower lip aristate, of side-lobes mucronate. Nutlets become very gelatinous in water.

4. **O. sanctum,** *L.* Tulsi, *H., Beng.*; The Sacred Basil.

An undershrub 2–4 ft. high much branched, the whole plant often of a purple colour. Twigs pubescent or with short, rather hispid, and long soft hairs. Leaves 1–1·5″ or 2″ ovate, ovate-oblong or elliptic-oblong, hairy or pubescent both sides and very glandular between the nerves beneath. Flowers very small, purplish or crimson, ·15–·17″ long, whorled in racemes 3–8″ long which are often panicled. Calyx glabrous within, villose and very glandular without, in fruit about ·14″ measured along upper and ·18″ along lower lip. Bracts sessile or shortly petioled, broadly cordate, finally reflexed. Nutlets reddish, or yellow with small black markings (the red and white varieties), broadly ellipsoid, smooth or nearly so, ·05″ long.

Grown in the courtyards of every Hindu house, often in pots. Occasionally seen apparently wild, *e.g.* near the Bansloi River in the Santal Parganas! Also waste ground, Purneah and Angul. Fl., Fr. c.s.

Twigs somewhat 4-angular. Leaves crenate-serrate, rarely entire in our area, acute or obtuse, sometimes nearly glabrous between the nerves beneath. The inflorescence of very different appearance from *O. canum* on account of the slender pedicels usually exceeding the calyx, and not being appressed vertically to the rhachis but more or less patent and the tip less reflexed and the fruiting upper lips not regularly touching one another in fruit, ·08–·1″ broad. Lower calyx-lobes aristate, lateral more shortly aristate. Disc very prominent on upper side. Calyx often with few very long hairs and whitish shorter ones. The nutlets do not become much swollen and mucilaginous in water like those of *O. canum* and *O. basilicum*.

Sacred to Vishnu. A domestic remedy for catarrh, cough (infusion of the leaves), etc., and, applied externally, for cutaneous diseases. It is also believed to drive away mosquitoes. Rosaries are made from the stems.

2. ORTHOSIPHON, *Benth.*

Shrubs or herbs with a woody rootstock or roots sometimes tuberous; much less aromatic than *Ocimum*, which it often closely resembles, but differs in the calyx being often relatively longer in the tube and with several nerves between the principal 10, in the usually more slender corolla-tube, in the filaments toothless and glabrous, and, especially, in the minute simple capitellate or clavate stigma. Nutlets usually sub-globose.

A. Stamens included:—
1. Leaves small, under 2″:—
L. elliptic or ovate, ·7–1·5″. Fls. ·3″ . . . . . 1. *pallidus.*
2. Leaves 2–4″ long, oblong or elliptic-oblong:—
L. rounded or subacute at apex. Petiole 0–·25″ . . . 2. *rubicundus.*
L. acute or sub-acuminate. Petiole ·7–1″ . . . . 3. *incurvus.*
3. L. 2–3″ long, broadly ovate. Petiole 1–1·7″, slender . . 4. *glabratus.*
B. Stamens far exserted. L. ovate, 2–3·5″ . . . . . 5. *grandiflorus.*

1. O. pallidus, *Royle.*

A small scarcely woody plant 4–12″ high with many more or less erect or diffuse branches from near the rootstock, sharply 4-angled and puberulous above. Leaves ovate or elliptic ·7–1·3″ (–2″, *F.B.I.*), attenuate at the base, crenate-serrate with teeth often few, pale beneath. Flowers racemed, about 6 in a whorl, ·3″ long, deflexed with pedicels erect or subpatent in fruit. Calyx glabrous within, many-nerved, without long hairs but hispidulous outside, ·25″ long in fruit with 2-awned lower lip about as long as the broad upper. Nutlets pale globose (*F.B.I.* says compressed subglobose; perhaps these were not quite ripe).

Shahabad, *Hope*! Singbhum, frequent! but not recorded from Chota Nagpur in *Bengal Plants* and probably often mistaken for an *Ocimum*. The Central Provinces may also be added to the distribution recorded in *F.B.I.* Fl., Fr. r.s.–Oct.

Leaves glabrous except on the nerves beneath (or finely pubescent, *F.B.I.*), mostly obtuse punctulate with glands, but nearly odourless, base narrowed into a petiole ·25–·4″ long. Racemes 2–4″, whorls often dense. Calyx ·12″ along both upper and lower lips in flower, upper lobe in fruit ·12″ broad, broadly-oblong rounded, those in a whorl often meeting one another as in *Ocimum canum*. Corolla white.

2. O. rubicundus, *Benth.*

A herb with stems 8″–20″ high from a woody rootstock, which has also the roots swollen into turbinate tubers 1–3″ long. Leaves sessile or shortly petioled, oblong or elliptic-oblong, 2–4″ long, crenate or serrate coarsely puberulous or glabrate above, paler and glabrous or hispidulous on the nerves beneath. Flowers white, lilac or rose in rather distant 6-fld. whorls on long terminal racemes 4–12″ long. Calyx ·2″ in flower, ·3″ in fruit, minutely pubescent, upper lobe sub-petaloid, purple. Corolla twice as long as calyx or up to ·5″, tube about ·3″, pubescent. Nutlets suborbicular compressed, punctulate.

Common in the forests of the Central Tract. Monghyr, *Ham.*! Santal Parg.! Throughout Chota Nagpur! Probably throughout the Southern Tract, but specimens only collected from Kalahandi! A specimen from Mayurbhanj, *Hooper*! is referred to *O. incurvus*, *Benth.*, in the *Cal. Herb.* The flowers are ·6″ long, but it is, I think, this species. Fl. April–June, the shoots springing up after the jungle fires.

Stems sometimes tomentose, at others slightly pubescent only, 4-angled. Leaves rarely 4·75″ long, rounded or subacute at the tip, never acuminate, base usually cuneate. Petiole 0–·25″ on same individual. *Bentham's* variety *rigida*, however, is characterised solely by "leaves petiolate." Calyx over 12-nerved at base in fruit, upper lobe of lip only slightly decurrent on the tube, not forming a large shield on it as in *Ocimum*, ·1–·12″ broad in fruit; lower lip with 2 awns projecting beyond upper, side lobes with shorter awns. Bracts sessile ovate or oblong reflexed, ·05–·1″. Stamens 2, upper not as long as the lip, 2 inferior included in the tube, filaments glabrous.

3. O. incurvus, *Benth.*

Closely resembling *O. rubicundus* but the leaves acute or almost acuminate tapering both ends, 3–4″, coarsely crenate, sec. n. 4–6. Petiole ·7–1″. Flowers larger, ·6–·8″. Calyx ·25″ in flower, ·3–·5″ in fruit, lower lip awned. Corolla blue or purple-red.

Native of the sub-Himalayas, Assam and Silhet. Fl. July–Oct.

A specimen from Mayurbhanj, collected by *Hooper*, is called *O. incurvus* in the

Calcutta Herbarium. The flowers are ·6″ long and leaves shortly petioled, but it is, I think, *O. rubicundus.*

4. **O. glabratus,** *Benth.* Syn. O. tomentosus, *Benth.* Var. glabrata, *F.B.I.*

Slender, 2–3 ft. high, scarcely woody below, much branched, branches 4-angled, grooved and striate, nearly glabrous. Leaves broadly ovate, crenate or dentate-serrate, 2–3″ and nearly as broad, puberulous along the nerves beneath, otherwise glabrous, base nearly straight or very slightly cuneate on petiole, which is 1–1·7″ long and slender. Flowers ·3–·4″ long about 6 in a whorl in slender racemes 3–7″ long with small ovate cuspidate reflexed bracts ·05–·07″. Fruiting calyx deflexed ·3″ to end of awns of lower lip (which project beyond upper), thinly pubescent, upper lobe ·14″ broad in fruit, somewhat coloured. Nutlets broadly-ellipsoid brown, smooth (not quite ripe).

Mals of Puri! Fl., Fr. Nov.-Jan.

L. very acute, pale beneath, sec. n. 4–6, of which one from base, fine but clear. Racemes with pubescent rhachis. Pedicels ·1″ suberect. Calyx with the nerves between the three main ones of upper lip not as clear as in most *Orthosiphon*, upper lobe somewhat apiculate, decurrent at sides, lateral scarcely aristate. Corolla-tube ·2–·25,″ puberulous. Stamens shorter than lower lip, upper pair sub-included. Stigma minutely 2-lobed.

5. **O. grandiflorus,** *nov. comb.* Syn. Ocimum grandiflorum, *Blume* (1825); Orthosiphon stamineus, *Benth.* (1830).

A very pretty species 1–2 ft. high with 4-angled nearly glabrous stems, petioled ovate acuminate coarsely obtusely serrate leaves 2–3·5″ long and pubescent purple flowers with corollas ·5–·75″ long, and declinate stamens exserted to 1″ beyond the corolla. Seeds (not seen by me) broadly oblong compressed, rugulose (*J.D.H.*).

Shady places, Latua Forest, Singbhum! Fl. Aug.-Sept.

Herbaceous. L. cuneate at the base, puberulous on the 4–5 sec. n. beneath, not very clearly punctulate. Petiole ·5–1″. Pedicels about ·15″, longer or shorter than the ·13–·2″ long tubular calyx, of which the lower teeth are subulate, but not awned and upper lobe not as broad as in other species.

3. GENIOSPORUM, *Wall.*

Herbs with small or minute flowers in many-fld. whorls in dense or lax spikes or racemes with the bracts often white or coloured. Calyx ovoid in flower, tubular and strongly transversely ribbed or pitted in fruit, suberect or declinate, 5-toothed, upper tooth broadest but not decurrent. Corolla 2-lipped, tube short, upper lip 4-fid, lower declinate entire. Filaments free, exserted. Disc tumid, gibbous. Style arms short flattened. Nutlets ovoid or oblong, smooth or sometimes punctulate.

Erect, 1–3 ft. high:—

Leaves 2–4″, ovate or lanceolate, petioled	1. *strobiliferum.*
Leaves linear or narrow-lanceolate, 1–2″, subsessile. Fruiting-calyx ·2″	2. *elongatum.*
Prostrate, with leaves narrow, sessile, very unequal. Fruiting-calyx ·1″	3. *prostratum.*

1. **G. strobiliferum,** *Wall.*

An erect, little-branched herb 2–3 ft. high with puberulous stems and ovate or lanceolate serrate leaves 2–4″ long and small white

flowers in dense spikes 2–4″ long, often supported by a pair of white leaves, and the bracts white or greenish-white. Fruiting calyx erect, tubular, ·12″ long, pubescent with 2 black glands on the upper lip (*F.B.I.* says *lower*).

Northern Champaran, in the Ramnagar Hills! Perhaps also in Purneah. (I have collected it in the adjacent Sikkim Tarai.) Fl. Aug.–Oct. Fr. Nov.

L. with short scattered hairs, shortly acuminate, base acute or rounded and cuneate on the petiole which is ·25–·75″ long, sec. n. 8–10 distinct. Bracts broadly rhomboid ovate. Pedicels very short. Calyx pubescent, throat glabrous. Corolla hairy with purple veins. Nutlets ellipsoid black, hispid towards the top (*J.D.H.*).

2. **G. elongatum,** *Benth.*

A herb 20–30″ high with 4-angular somewhat hispidly retrorsely hairy strict stems, distant pairs of linear or linear-lanceolate pubescent leaves 1–2″ long and terminal dense spikes ·75–2″ long of small pale-purple and white flowers. Bracts orbicular-obovate decussate, often white or pale, ·25–·3″ long, ·3″ broad, villous beneath. Fruiting-calyx closely ribbed, sometimes pitted from the raised close transverse nerves.

Palamau, Pendra Valley, 2000 ft.! Fl., Fr. Sept.–Nov.

L. tapering to the subsessile base, serrate, thinly strigose above, gland dotted between the nerves beneath, sec. n. about 6 prominent and hairy beneath, depressed above. Fls. many, shortly pedicelled, reaching to the margins of the bracts. Calyx ·12″ naked within with villose or woolly tube shorter than the upper lip, very unequally toothed, upper lobe oblong, lateral teeth lanceolate, lower minute. Corolla ·15–·2″, hairy, 2 central lobes of upper lip purple, 2 side-lobes purple-veined, lower lip white, not longer than upper, flat, oblong, acute. Fruiting calyx tubular ·2″ long, suberect and teeth erect enlarged hispid, 10-nerved, not pitted (pitted in Circars specimen, *J.D.H.*). Nutlets ellipsoid-oblong white smooth.

3. **G. prostratum,** *Benth.*

A diffuse or prostrate herb with slender stems 4–15″ long from a somewhat woody rootstock and rhomboid or elliptic sharply distantly serrate leaves ·3–·5″ long narrowed into the petiole, or (var. *gracilis*) narrow linear-lanceolate or linear-oblanceolate leaves ·3–1·3″ long. Flowers very small, somewhat like those of wild Thyme, on slender pedicels in cymose whorls racemed at the ends of the branches; racemes 2–6″ long with ovate or narrow-ovate acute reflexed bracts. Fruiting calyx ·1″, tube ribbed, about as long as the teeth, glandular and thinly hairy outside, throat closed with hairs, 2 anterior teeth narrower and sharper than the others.

This is recorded from Orissa in *Bengal Plants* and it possibly does extend as far as the Puri coast but the specimens are *not* from Bengal Orissa but from Ganjam in Madras, *i.e.* Orissa in the older and wider sense. It is a common sea-side plant in Ceylon. Fl. June–Sept.

4. ACROCEPHALUS, *Benth.*

Annual herbs with whorls of small flowers in dense heads with imbricating bracts. Calyx ovoid in flower, tubular in fruit with gibbous base, upper lip flat, entire, lower entire, 4-fid or 4-toothed, throat naked. Corolla-tube very short, subequally 4-lobed. Stamens 4 with the anthers scarcely exserted, filaments free. Disc small, gibbous. Style 2-fid. Nutlets smooth.

1. **A. capitatus,** *Benth.*

A small plant only 6″ high in fruit, or attaining 2 ft. Stems pubescent. Leaves ovate or lanceolate, ·5–1″, dentate or coarsely serrate, base narrowed into the petiole, nearly glabrous. Flowers minute, pink (with the lowest petal pale), in dense sub-globose heads ·3–·6″ long. Bracts ·17″ long and broad, cuneate at the base and very obtuse at the tip. Calyx hairy, in fruit tubular, ·12–·17″ long, with lobes one-third or one-quarter as long as tube, upper oblong or linear-oblong flat, 4 lower linear hispid; the upper lobe closes the calyx in young fruit but again opens with maturity. Seeds oblong, smooth, dark-brown, ·03″.

Damp or shady places in the forests. Singbhum, common! Angul, *Chattarjee*! Judging from its general distribution it will be found in all the hilly districts of the area in damp forests. Fl., Fr. Oct.–Dec.

The normal plant is erect, often with the heads sub-panicled above. Upper India specimens have elliptic leaves 1·5″ long, coarsely toothed with attenuate base. The Angul plant appears to be diffuse and has narrowly lanceolate leaves and the small heads are only ·25″ diam. Fruiting-calyx ·1″ flask-shaped with one oblong upper lobe and 4 small subulate lower lobes. Corolla ·07″ long. It is perhaps a distinct variety.

5. ANISOCHILUS, *Wall.*

Herbs or undershrubs, often fleshy. Flowers small in dense oblong 4-gonal or cylindrical spikes. Calyx suberect, inflated below the middle, mouth oblique 2-lipped or 5-toothed, rarely 1-lipped, upper lip entire and deflexed or short and 3-crenate. Corolla with slender decurved tube, short entire or 3–4-fid upper lip and elongate concave lower lip. Stamens 4, declinate, filaments free, anther-cells confluent. Disc lobed.

A. Fruiting calyx with the upper lip entire deflexed over and concealing the mouth, lower truncate or obscurely toothed:—	
Calyx glabrous, shortly pubescent and ciliate	1. *carnosus.*
Calyx villous or woolly	2. *eriocephalus.*
B. Fruiting calyx split in front, mouth very oblique, 1-lipped, lip decurved 5-toothed, not closing the mouth	3. *polystachyus.*

1. **A. carnosus,** *Wall.*

An erect herb 2–3 ft. high, variable in indumentum, with long-petioled ovate crenate rather fleshy leaves and panicled long-peduncled short spikes, 1–1·5″ long of pale purple flowers, conspicuous in bud by the 4-ranked, subsequently deciduous bracts. Whole inflorescence covered with small red glands. Lower lip of calyx truncate, upper ovate acuminate erect in flower but deflexed in bud and in fruit, ·1″ long.

Singbhum, in rocky places, especially on limestone rocks! Palamau! Ranchi, similar localities! Fl, Oct.–Nov.

It is said to be very variable. The following details belong to the Chota Nagpur specimens. Stem very stout below, 4-gonous, villous, sparingly branched. Lower leaves 4·5 by 3·25″, base rounded, apex obtuse or subacute more or less villose and with minute red glands (which are not noticed by the *F.B.I.*). Petioles 2–3″. Spikes pyramidal (elongating to 3″, *F.B.I.*) on peduncle 2–4″ long, the lower sometimes with a small pair of leaves and branched. Pedicels very minute, red with glands. Bracts ·2″. Calyx very shortly pubescent and ciliate. Corolla ·42, upper lip purple erect, lower constricted at base elliptic concave ·12″, pubescent and red-glandular in bud.

2. A. eriocephalus, *Benth.*

As stated by *Hooker*, probably only a variety of *A. carnosus*, than which it is more slender, glabrous or puberulous, leaves broadly ovate or cordate, crenate. Peduncles slender, spikes many ovoid or cylindric, calyx villous or woolly, upper lip broadly ovate acuminate, deflexed as in the last.

Kymore Hills, *J.D.H.* Ranchi, Neterhat? My specimens had short heads ·5–·7″ and a sub-aristate upper lip. They were old and leafless (December).

3. A. polystachyus, *Benth.*

Of very different appearance from the last two species, being a robust herb with erect strict hoary stems 3–8 ft. high with subsessile lanceolate acuminate leaves 3–6″ and panicled spikes 1·1·5″ long of white or cream reflexed flowers.

Common in Savannah tracts of Jalpaiguri and will probably be found in the grass tracts of Purneah. Fl. Nov.

6. PLECTRANTHUS, L'Herit.

Herbs or undershrubs with usually square stems, opp. or ternate leaves and small flowers in panicled or racemed 6–8-fld. cymes or whorls. Calyx 2-lipped, 5-toothed, sometimes unequally, enlarged in fruit. Corolla-tube exserted, long or short, straight or decurved, limb equal or gibbous or spurred, 2-lipped, upper lip short broad, 2–4-fid recurved, lower much larger, longer, entire, boat-shaped, narrow or stipitate at the base. Stamens 4 declinate; filaments free, anther-cells usually confluent. Disc usually produced in front, large. Nutlets orbicular ovoid or oblong, smooth granulate or punctate.

A. Calyx-teeth sub-equal and similar:—	
Calyx-teeth rounded. L. lanceolate 2–7″ hoary	1. *ternifolius.*
Calyx-teeth lanceolate acute. L. ovate	2. *menthoides.*
B. Upper calyx lobe broadly ovate:—	
Leaves ovate, cordate. Cymes 2-3-fld. only	3. *incanus.*

1. P. ternifolius, *Don.*

An undershrub 3–5 ft. high, densely white-tomentose all over, with strict erect branches, opposite or 3-nately whorled lanceolate, acuminate, serrate, rugose leaves 2–7″ long, and sub-sessile white flowers in dense whorls on the spiciform branches of long narrow hoary panicles. Fruiting calyx erect, tubular, equally 5-toothed. Corolla ·2″ with decurved tube only ·05″, gibbous above the base. Nutlets 3-gonous, ovoid-oblong, acuminate.

In grass tracts and thin forest. Purneah, very common! Chota Nagpur, on the pats 3000 ft. and above, and Parasnath 4000 ft.! Fl. Nov.–Jan.

Stems villosely tomentose. Leaves sometimes oblong-lanceolate, green and shortly hairy above, hoary-pubescent beneath. Petiole ·2–·3″. Calyx in fruit ·2″, straight, teeth rounded. Upper lip of corolla with pink spots at the base, 2-fid with the segments again 2-lobed.

2. P. menthoides, *Benth.*

A tall robust herb 5–8 ft. high with square densely pubescent stems up to ·3″ diam., often grooved on the faces. Leaves opposite, rugose above, ovate acuminate, dentate, base decurrent on petiole, larger 4″ by 2″ with petiole ·5″. Flowers ·2–·3″ long, blue in terminal

thyrsoidly panicled stalked 2-chotomous cymes in the axils of the leaves or bracts. Calyx ·12″ campanulate, pubescent, sub-2-lipped, teeth sharply lanceolate; in fruit decurved. Corolla hairy, tube ·15–·16″, equalling or exceeding the lower lip, declinate, suddenly swollen above the very short base, gibbous above.

In wet grassy places, also on cool hill sides but then less tall; Neterhat, 3000 ft.! Fl., Fr. Oct.–Dec.

Very aromatic. Leaves pubescent both sides. Cymes divaricate, ·5″ long. Upper lip of corolla with 4 rounded lobes and violet markings, lower boat-shaped, pale blue. Filaments declinate, 2 lower longer. Nutlets oblong.

This, as *Clarke* states, is probably only a variety of *P. cœtsa*. I class it under *P. menthoides* because the corolla-tube in *P. cœtsa* is much shorter than the lower lip.

3. **P. incanus,** *Link.*

An erect coarse herb or undershrub 3–4 ft. high with square stems, long-petioled velvety ovate cordate crenate leaves 2–4″ by 1·75–4″ with a strong smell, and terminal racemes or panicles of small pale-lilac flowers ·3″ long, arranged mostly in opposite peduncled 2-fld. cymes in the axils of small green bracts ·15–·25″ long. Calyx ·12″ long, enlarged to ·45″ in fruit with an upper broadly ovate lip and a lower lip with 4 long subulate teeth. Seeds grey-brown subglobose with sparse small dark warts.

Waste ground near villages under shade, or among rocks or in the open on the pats. Singbhum! Ranchi plateau, common! Parasnath, *Kew Herb.*! Fl. Aug.–Sept. Fr. Oct.

The name is not a very happy one as the plant, although shortly softly pubescent, is scarcely grey or hoary. L. acute, deeply cordate, gland punctate beneath. Lower petioles 3–4″ long. Cymes of 2–3 fls. on a short common peduncle with pedicels ·3–·5″. Corolla pubescent, tube only slightly exserted, boat-shaped lower lip about ·2″.

7. COLEUS, *L.*

Characters of *Plectranthus* but flowers often large and filaments combined below into a sheath round the style.

A. Indigenous species:—
Whorls 6-10-fld. Fruiting calyx decurved, hairy in throat . 1. *Forskohlii.*
B. Cultivated species. Calyx glabrous within:—
1. Whorls dense globose. Fruiting calyx suberect:—
Leaves very thick, sweetly scented . . . . . 2. *amboinicus.*
2. Whorls loose, laxly cymose. Fruiting calyx decurved:—
L. membranous, rounded at base. Calyx glabrate . . 3. *scutellarioides.*
L. often variegated, acute at base. Calyx hirsute . . 4. *Blumei.*

1. **C. Forskohlii,** *Briq.* Syn. C. barbatus, *Benth.*; Plectranthus Forskohlii, *Willd.*

A herb 1–2 ft. high with decumbent and ascending stout villous stems and rather fleshy ovate crenate obtuse leaves 3–4″ long. Flowers pale blue ·75–·9″ long in rather distant 6–10-fld. whorls in villous racemes 5–10″ long. Calyx villous in the throat, ·3″ in fruit with the lower subulate-subaristate teeth half as long as the stout tube, upper lip ovate rounded broadly ovate, cuspidate. Corolla with large stipitate boat-shaped lower lip.

Top of Parasnath! Fl. Nov.

2. **C. amboinicus,** *Lour.* Syn. C. aromaticus, *Roxb.*; Pathar-chur, Vern.

Shrubby below, villous, with short petioled orbicular cordate crenate very thick, crenulate, slightly hairy leaves about 1–2″ long and broad. Flowers very small blue or pale purple in very dense distant whorls; in bud with 4 rows of caducous bracts. Common in gardens. Fl. May-June.

3. **C. scutellarioides,** *Benth.* Syn. Ocimum scutellarioides, *L.*

A tall slender plant 2–3 ft. high with petioled ovate or ovate-lanceolate acuminate crenate membranous leaves 2–3″ and flowers ·5″ with abruptly decurved tube. Racemes elongate slender. The leaves are usually purple beneath.
Common in gardens.

4. **C. Blumei,** *Benth.* Syn. Plectranthus scutellarioides, *Blume.*

Briquet states that this is the parent of most of the beautifully variegated-leaved *Coleus*, sometimes crossed with its congeners *C. bicolor*, Benth., and *C. laciniatus*, Benth. All are natives of and cultivated in Java. The whorls are secund in elongate racemes, the lower lip of the hirsute calyx is 3-fid with the middle segment longer and 2-lobed. *C. laciniatus* has the leaves inciso-serrate.
Very common in Indian verandahs, often with the last.

8. HYPTIS, *Jacq.*

Herbs or shrubs with (in our species) small flowers disposed in dense cymose whorls and these in panicled spikes or racemes, cymes sometimes capitate when young. Calyx campanulate, ovate or tubular, equally 5-toothed, often accrescent in fruit. Corolla with cylindric or somewhat widened or ventricose tube, 2-lobed upper lip, abruptly deflexed saccate lower lip contracted at the base and the side lobes united either with the lower or upper lip or free. Stamens 4 declinate, anther-cells confluent. Style sub-entire or 2-fid.

A very large American genus with some 300 species.

1. **H. suaveolens,** *Poit.* Ganga Tulsi, *S., Or*; Purudo, *Mal Pah.*

A tall, coarse, branched, very sweet-smelling herb, varying in stature but attaining 6 or 7 ft. in congenial situations, with obtusely 4-angled stems often ·5″ diam. Leaves ovate sinuate and crenate-denticulate, lower 4·5″ by 3·5″, slightly cordate, hairy, upper smaller not cordate. Flowers small blue, when young often capitate 2–4 together on an axillary peduncle (in globose heads, *J.D.H.*), or in bracteate axillary racemiform cymes or, in luxuriant specimens, cymes collected into thyrsiform almost leafless panicles one foot or more long. Filaments hairy. Calyx compressed sub-2-lipped somewhat deflexed, tube ·25″ long in fruit 10-nerved meeting in a marginal nerve and with an inflexed ring of hairs in the mouth, teeth subulate-aristate strong. Nutlets compressed ovoid oblong, emarginate at tip, pointed below, ribbed, ·12″ long.

Completely naturalised in most parts of the province in open waste ground. Singbhum! Ranchi! Very common in the coalfields of Manbhum! Santal P., very common! Puri, local! Angul, *Chattarjee*! Sambalpur! Athmallik! Fl. Oct.-Nov. Fr. Nov.-Jan.
Very glandular. Calyx hairy and glandular. Corolla ·2″, upper lip shortly 2-lobed, lower (including side-lobes) 3-lobed.
The plant, pounded, is applied in parasitical cutaneous diseases, *Camp.*

9. LAVANDULA, *L.* Lavender.

Herbs or shrubs with entire or sometimes pinnatisect leaves and blue, violet or lilac flowers in 2–10-fld. whorls, collected into simple or branched spikes. Calyx erect, 13–15-nerved, 5-toothed. Corolla with 2-fid upper and 3-partite lower lip, lobes spreading. Stamens 4 declinate, included, free, anther-cells confluent. Disc-lobes opposite the ovary-lobes. Style 2-fid. Nutlets smooth, areole slightly dorsally oblique.

The species of Lavender are chiefly Mediterranean.

1. **L. bipinnata,** *Roth.* Syn. L. Burmanni, *Benth.*

A pretty, slender, erect herb 2–3 ft. high with 1–2-pinnatisect leaves with linear segments, and capitate spikes ·3–1·25″ long of lavender-coloured and -scented flowers.

Pats of Chota Nagpur: Ranchi! Palamau, Neterhat, 3000 ft.! Fl. Nov.–Jan.

Leaves 3–4″ long, segments very narrow. Spikes sometimes panicled, bracts 1-fld., ovate-acuminate (subulate, *F.B.I.*), shorter than the tubular 15-nerved pubescent, ·2″-long calyx. Corolla sometimes white, ·45″ on long diameter with tube ·3–·4″ slender, inflated above, throat hairy. Lower lip deeply 3-lobed with midlobe largest obovate, upper lip paler notched, outside pubescent. Stamens with lower pair longer, anthers rounded, pubescent. Nutlets oblong ·06″ long with a broad dorsal groove in continuation of the oblique areole not quite reaching to the rounded apex.

10. POGOSTEMON, *Desf.*

Herbs or shrubs with small flowers in subcapitate whorls or cymes arranged in solitary or densely panicled spikes or contracted racemes. Calyx sub-equally 4–5-toothed. Corolla sub-2-lipped with exserted or included tube and spreading limb of 4 lobes, lower usually longest. Stamens 4 exserted, straight or declinate, filaments usually bearded, anther-cells confluent. Disc regular sub-entire. Style 2-fid. Nutlets smooth ovoid or oblong.

1. **P. plectranthoides,** *Desf.* Jin, *Beng.*; Ishwar-jata, *Khond*; Poksunga, *Or.*

A suffruticose herb or shrub 4–6 ft. high; stems with 4 rounded corners glabrous or hairy with adpressed hairs. Leaves ovate, rarely lanceolate acute or subacuminate with straight or very obtuse or shortly suddenly cuneate base, 3–5″ but smaller towards the inflorescence, coarsely doubly serrate. Flowers white or pale but appearing pink from the conspicuous light-purple bearded stamens and style, in capitate secund bracteate spikes, which again are arranged in dense secund panicled villous racemes. Bracts ·2–·25″ long, ovate, ell.-ovate or oblong-rhomboid, villous, overtopping the flower-buds.

In shady forest or along streams, sometimes forming a dense thicket. Champaran! Santal Parg.! Singbhum, local! Parasnath, *Kew Herb.*! Angul, common! Kalahandi! Fl. Jan.–Feb. Fr. April.

Branches often purple. Shoots and young leaves beneath hoary pubescent, mature leaves sometimes with a short mealy pubescence and minutely glandular beneath and very sparsely shortly hairy above, generally glabrescent, nearly scentless but inflorescence with a strong smell, sec. n. rather strong 4–6 very oblique. Petiole 1–2″. Calyx ·15–·17″ long, sub-2-lipped, two teeth rather broader

than the other three, half to two-thirds as long as tube, villose-pubescent and minutely glandular. Upper corolla-lip with 3 rounded lobes, lower entire lanceolate acute. Villi on stamens jointed.

2. **P. parviflorus,** *Benth.*

This plant, which is distinguished from the last by the much more slender spikes and narrower bracts, occurs from Kumaon and Nepaul to Sikkim and Assam. It may therefore possibly occur along our northern frontier especially in the Champaran Hills. In the *F.B.I.* it is stated that it may be distinguished by never being hoary as in *B. plectranthoides* but the last is very frequently not at all hoary in the field.

11. DYSOPHYLLA, *Blume.*

Herbs with opposite or wholed leaves and minute flowers sessile in close whorls collected into dense terminal spikes. Calyx very minute, ovoid, equally 5-toothed, throat naked. Corolla minute, tube exserted or included, limb nearly equally 4-fid with the upper lobe entire or 2-lobed, lower spreading. Stamens 4 exserted, somewhat unequal, straight or subdeclinate, filaments very long-bearded, anther-cells confluent. Disc regular, subentire. Style 2-fid. Nutlets smooth or rough, ovoid or oblong.

A. Calyx not angled and furrowed :—
  1. Leaves in pairs (rarely a few ternate in 2), hairy :—
    Stems with spreading hairs. L. 2·5–3″ mostly serrate. Spike ·25–·3″ diam. . . . . 1. *auriculata.*
    Stems with adpressed hairs. L. 1–1·5″ mostly entire. Spike ·4–·5″ diam. . . . . 2. *Andersoni.*
  2. Leaves 3-5-nately whorled, or a few upper paired :—
    a. Stems and leaves tomentosely hirsute or villous :—
      Branched above. L. lanceolate, serrate, 1–4″ . . . 3. *quadrifolia.*
      Strict with solitary spikes. L. linear, entire, ·7–2″ . . 4. *cruciata.*
    b. Glabrous or nearly so, often decumbent at base :—
      L. 1–3″ spreading and deflexed. Calyx teeth stellately spreading in fruit. Spikes mostly under ·2″ diam. . 5. *verticillata.*
      Calyx teeth erect in fruit. Spikes over ·2″ diam. . . 6. *crassicaulis.*
B. Calyx with 5 alternate furrows and ridges :—
  Calyx pubescent all over. Ridges obtuse . . . . . 7. *pentagona.*
  Calyx only pubescent at tip. Ridges acute . . . . . 8. *Griffithii.*

1. **D. auricularia,** *Blume.*

A very hairy herb 18″–2 ft. high, scarcely scented, with distant pairs of ovate-oblong or ovate-lanceolate, hairy obtusely serrate leaves 2·5–3″ long below, and terminal dense spikes of white or pale lilac flowers with bearded exserted filaments. Calyx ·06″, campanulate, teeth equal triangular half as long as tube. Fruiting calyx turbinate with mouth closed by the inflexed lobes. Corolla subregular with 4 rounded lobes. Nutlets pale brown, smooth, ellipsoid.

In grass near streams on the pats of Chota Nagpur. Neterhat, 3000 ft.! Fl., Fr. Sept.–Nov.

Stem with spreading hairs, terete below, slightly angled above. Leaves gland-punctate beneath, sec. n. oblique, about 8. Petiole ·1–·2″. Spikes 1–1·5″ long in flower but elongating to 4″ or more in fruit with a nodose villous rhachis, about ·25–·3″ diam. Bracts under ·1″ oblong or spathulate-oblong ciliate. Flowers ·17″.

2. **D. Andersoni,** *Prain.*

An erect strict stoutish herb with appressed hairy stems, about 6″ high, leaves opposite or sometimes 3 in a whorl 1–1·5″ by ·3″ tomentosely hairy lanceolate or narrowly oblong with shallow

distant serratures or entire, and a much stouter spike than in the last 1·5–2″ long by ·5″ diam. after fall of the flowers.

Singbhum in the Tirilposi savannah, 2000 ft.! Also recorded from the Duars, and the type was collected by *T. Anderson* in the Sikkim Tarai; it may therefore be found in northern Purneah. Fr. March.

The following is the description of the type in the *Journal of the As. Soc. Bengal*:— Dwarf stout erect 8–15 cm. branched, branches erect stoutish woody, stems and leaves both surfaces adpressed pubescent. L. opposite, sessile, 3–4 cm. long, lanceolate or oblong-lanceolate acute entire. Spikes short, stout, 15–20 mm. long, 10 mm. wide, softly tomentose. Whorls confluent. Calyx short glabrescent, in fruit 2 mm. long, teeth erect, bluntly triangular, half as long as tube, hirsute, tube glabrous externally. Corolla-tube included, lobes sparingly hairy. Nutlets globose smooth, shining, red-brown, not trigonous.

3. **D. quadrifolia,** *Benth.*

Stems 2–4 ft. high, tomentosely hirsute upwards, from a thick root-stock. Leaves opposite and 4 in a whorl, narrowly lanceolate or linear-oblong, 1–4″ long, tomentosely hairy, strongly nerved, serrate, petiole 0–·2″. Spikes very dense 3–6″ long by ·25–·3″ diam. with sometimes detached whorls below. Bracts linear as long as the calyx. Calyx campanulate in flower hirsute or villous, equally 5-toothed, tubular in fruit and ·08–·1″ long. Nutlets minute brown ovoid with small areole.

Singbhum, on the Keonjhur boundary, elev. 3000 ft.! Angul, *Lace*! Mailagiri Hill, Palahara State, *Cooper*! Fl. Dec.–Feb. Fr. March–April. Perennial, new shoots appear in April.

The spikes are sub-panicled. Calyx with small glistening glands, teeth erect in fruit.

4. **D. cruciata,** *Benth.*

A very pretty herb often growing gregariously with erect strict densely villose stems 12–20″ high, whorls of 3–5, usually 4, sessile sub-erect linear leaves ·7–2″ long with revolute entire or slightly toothed margins and terminal solitary spikes 1–3″ (rarely 5″) long of lilac or pale-purple flowers with purple-bearded stamens.

Frequent in rice fields and wet places in the hills, often amongst grass. Champaran! Purneah! Ranchi, elev. 2000 ft.! Singbhum, elev. 2000 ft.! Sambalpur, *Griffiths*! Fl., Fr. Oct.–March.

L. densely hirsutely villous both sides, slightly narrowed upwards and sometimes also towards the base, obtuse or subacute. Spikes with a peduncle ·8–1·5″, about ·4″ diam. when with flower or ·3″ diam. in fruit. Bracts linear slightly exceeding the villous calyx. Corolla white, lobes glabrous. Fruiting calyx tubular-campanulate with erect teeth, ·06–·08″ long, villous and with glistening glands. Seeds minute, black, polished, broadly elliptic oblong with minute attachment point.

5. **D. verticillata,** *Benth.*

Usually branched, hollow-stemmed below with often decumbent base, 12–20″ high or flowering when simple and only 3–4″ high, glabrous or very sparsely hairy. Leaves linear or linear-lanceolate, 4–5 or up to 10 in a whorl, entire or crenate-serrate, 1–3″ long, spreading and deflexed, glabrous or nearly so. Spikes rarely over 2·5″ long and under ·2″ diam. in fruit, very dense, the widely open fruiting calyx looking like large holes in a solid spike and very characteristic, the lobes stellately spreading and disclosing the pale brown nutlets.

Purneah, *Kurz*! Gya, *Cal. Herb.*! Manbhum! Fl., Fr. Nov.–Dec.
The peculiarity of very small slender plants flowering in company with very large stout ones is quite characteristic of this and of the next species.

6. **D. crassicaulis,** *Benth.*

Habit of the last with lower decumbent parts of stems sometimes as thick as the fingers. Leaves linear-lanceolate or nearly linear, mostly 4–5 in a whorl. Distinguished by the larger spikes 1–4·5″ long and ·3–·4″ diam. Flowers larger, calyx ·09–·1″ in fruit, campanulate, shortly hairy with the teeth erect or conniving so that the fruiting spikes have a very different appearance. Nutlets very small, orbicular, compressed pale grey or black.

In rice-fields and swamps. Purneah! Fl., Fr. Nov.–Jan.
Our specimens have serrate leaves with rounded (sometimes acute, *F.B.I.*) sessile base. Bracts exceeding the buds, linear. Calyx purple.

7. **D. pentagona,** *Clarke.*

A small plant 4–8″ high or attaining 18″, growing gregariously in wet places with nearly glabrous stems and leaves, the latter linear 4 in a whorl ·3–1·5″ long, and with minute pink flowers in terminal slender pubescent spikes ·75–3″ long. Calyx in fruit sub-globose, densely pubescent, only ·06″ long, deeply 5-grooved, with obtuse ridges between the grooves and mouth closed by the minute obtuse teeth.

Singbhum, elev. 1000 ft.! Rare, but also collected by *Clarke* at Bandgaon, which is in Singbhum close to the Ranchi boundary, elev. 2000 ft.! Fl., Fr. Oct.–Nov. Annual.
Leaves sessile, obtuse, glabrous, margins somewhat revolute, base obtuse or acute, beneath gland-dotted. Corolla segments white, flat, obtuse. Stamens pink. Fruiting calyx glandular in the furrows, teeth closing over the small oblong brown seeds. (*N.B.—Clarke* says nutlet solitary, linear-oblong. This was probably exceptional.)

8. **D. Griffithii,** *Hook. f.*

A copiously branched erect glabrous or nearly glabrous herb with linear obtuse or subacuminate leaves ·5–1″ long, 4 in a whorl or uppermost opposite and slender pubescent spikes ·75–2″ long, ·15–·2″ broad. Calyx in fruit obconic only ·06″ long, broadly 5-grooved with acute ridges between the grooves, glabrous except for the tip and minute incurved densely shortly villous subacute teeth.

Rocky ground. Angul, *B. K. Chattarjee*! Sambalpur, *Griffiths*! Fl., Fr. Jan.–Feb. Annual.
Leaves sometimes tapering both ends, gland-punctate beneath, with one oblique slender nerve from near the base either side of the midrib, but other nerves obscure. Bracts linear, exceeding the flowers. Fruiting calyx sometimes brown, shining below the villous tip. Nutlets 2–4, minute, dark brown, suborbicular.

12. COLEBROOKIA, *Smith.*

Shrub with opposite or 3-nate leaves and small white flowers in dense whorls aggregated into panicled spikes. Calyx-tube very short; teeth long, subulate, in fruit elongating and plumose. Corolla minute, limb sub-equally 4-fid. Stamens 4, very short, included, equal, divergent, with small orbicular anthers with confluent cells. Disc regular. Style 2-fid with subulate lobes. Nutlets hairy, obovoid.

1. **C. oppositifolia,** *Sm.* Bhainsa, *S.*

A large spreading softly woolly shrub 5–10 ft. high with stout whitish branchlets, large white-tomentose crenate or crenulate leaves and very small white flowers in panicled spikes 2–4″ long. Calyx in fruit villous, deeply furrowed with plumose teeth ·12″ long.

Purneah! Valleys or rocky ravines in the hills in Chota Nagpur. Singbhum! Ranchi! Palamau! Hazaribagh (on Parasnath and valleys in Koderma forest)! Santal Par.! Fl. Dec.–Feb. Fr. Feb.–March.

L. sometimes 3-nate, 4–8″, elliptic or ell.-oblong acuminate with about 12 rather strong oblique sec. n. Petiole ·5–1·25″.

A preparation of the root is given in epilepsy, *Camp.*

13. ELSHOLTZIA, *Willd.*

Herbs or undershrubs, often beautifully scented. Flowers minute in whorls aggregated into simple or panicled, sometimes secund, spikes. Calyx 5-toothed, erect and often enlarged in fruit. Corolla with straight or incurved tube and oblique or sub-2-lipped limb, upper lobe or lip notched erect, lower spreading. Stamens 4 divergent or distant, sometimes unequal, filaments naked, anther-cells divaricate or finally confluent. Disc produced behind the ovary. Style subequally 2-fid, lobes subulate. Nutlets smooth or tubercled.

1. **E. incisa,** *Benth.*

An aromatic annual herb 8″–3 ft. high with square stems puberulous with adpressed hairs and deltoidly or rhomboidly ovate, very coarsely serrate leaves 1–2·5″ long. Flowers very small white, lipped, in dense terminal slender terete spikes 1·5–3·5″ long, or shorter on the lateral branches. Bracts subulate acuminate. Fruiting calyx tubular-urceolate, ·11″ long, 10-nerved, pubescent, with 5 subequal subulate teeth. Nutlets oblong-ellipsoid, brown, shining, attached by a very minute base.

Sunny slopes, pats of Chota Nagpur. Neterhat, 3500 ft.! Fl. Oct. Fr. Nov.–Dec.

Smell of Thyme. Stem angles rounded. L. with very conspicuous glands beneath, acute or acuminate, decurrent on the slender ·4–2″-long petiole, puberulous above and on nerves beneath, sec. n. 4–5, strong oblique and curved, tertiaries prominent. Spikes pubescent with decussate subulate bracts, ·1–·2″ long, slightly exceeding the flowers. Cymes 4–7-fld., sessile, fls. minutely pedicelled. Calyx ·05–·07″, campanulate, hairy and gland-dotted, upper tooth slightly longer. Corolla ·1″, densely pubescent, tube funnel-shaped, slightly curved, upper lip very short sub-truncate emarginate, lateral very short, anterior rather longer, half-orbicular. St. erect, 2 upper 2-celled, scarcely exserted, lower sometimes imperfect, sometimes one larger than all the rest.

Distrib.: Temperate and sub-tropical Himalaya and Chittagong.

Species of the genus **Mentha,** *L.* (Mint), are found in most Indian kitchen-gardens, and are well known under the vernacular name of *pudina.* The flowers in *Mentha* are often polygamo-dicœcious and many hybrids occur. I do not remember having seen any Mint in flower in our area, and the plants are propagated by division of the roots or underground stolons. The one commonly used in flavouring is usually referred to as *M. viridis, L.,* but the leaves are not lanceolate as in that species but orbicular-ovate or orbicular. It is more probably a

form of *M. sativa, L.*, itself believed to be a hybrid between *M. aquatica* and *M. arvensis*.

14. PERILLA, *L.*

Herbs or undershrubs with small flowers in 2-fid. whorls (fls. solitary in the bracts) collected into axillary and terminal secund racemes. Calyx campanulate 5-toothed, greatly enlarged in fruit and 2-lipped with gibbous base and dilated 3-toothed upper lip; lower lip with 2 lanceolate-subulate teeth. Corolla with short tube campanulate above, limb 5-fid with lobes unequal (lower usually larger than the 4 upper). Stamens 4 subequal erect distant, hardly exserted; anther-cells distinct, at first parallel, afterwards diverging. Disc large with a large posticous oblong lobe or gland. Style equally 2-fid. Nutlets subglobose, coarsely reticulate.

1. P. ocimoides, *L.* Ban Tulsi, *Beng.*

A strongly scented bush about 4 ft. high with villosely hairy 4-gonous and grooved branches, ovate coarsely serrate acuminate leaves 2·5–4″ long and small white hairy flowers 4-ranked in axillary and terminal secund spiciform racemes 1–3·5″ long. Bracts ovate or rhomboid rigidly acuminate. Calyx in flower ·1–·12″, hairy, with subulate teeth about equalling the sub-globose tube, in fruit ·28–·3″ long, broad upper lip with 3 oblong obtuse lobes, each 1-nerved, lanceolate lower teeth as long as upper lip and equalling tube.

Champaran. At the foot of the Ramnagar Hills! Fl., Fr. Oct.–Dec.

L. hairy on the nerves both sides and sparsely so between them above, gland-punctate beneath, base rhomboid or cuneate, sec. n. 6–7 oblique, very distinct but slender. Petiole ·75–1·5″ long, closely villous. Corolla white, hairy, ·15″ long, slightly exserted, with 4 subequal rounded lobes and a broader lower subtruncate lobe. Stamens erect, just reaching the throat of the villous corolla, anthers 2-celled. Fruiting calyx declinate, villous or nearly glabrous outside, but throat with a ring of long erect hairs. Nutlets ·07″.

15. MICROMERIA, *Benth.*

(Satureia, *L.*, in *Nat. Pflanz. Fam.**)

Herbs or undershrubs with usually small, entire or toothed leaves and small flowers in axillary whorls, sometimes whorls spicate or panicled. Calyx 10–13-nerved, 5-toothed or 2-lipped. Corolla 2-lipped, upper lip erect flattish, entire or notched, lower spreading 3-lobed. Stamens 4, lower longer ascending, incurved with diverging tips; anther cells distinct, parallel, at length diverging, connective usually thickened. Style-lobes equal or upper very short, lower recurved flattened.

Leaves ·5–1″ mostly serrate. Whorls dense-flowered . . . 1. *capitellata.*
Leaves ·17–·25″, entire. Whorls 2-few-flowered . . . . . 2. *biflora.*

1. M. capitellata, *Benth.* Buru-pudina, *S.*

A herb with strong mint odour, long slender erect, 4-angled, pubescent stems 1–2·5 ft. high, ovate or ovate-oblong mostly crenate-serrate leaves ·5–1″ long, and small purplish flowers in axillary, usually stalked, capitate cymes or uppermost running out into

* See note under *Calamintha*.

interrupted spikes, the leaves passing gradually into small lanceolate then linear bracts. Calyx tubular hairy ·08–·1″ (in fruit) with erect subulate hairy teeth half as long as tube, throat with a ring of hairs. Corolla very slightly exserted, straight, upper lip 2-fid, lower 3-lobed, with mid-lobe purple broader notched. Stamens included.

Pats of Chota Nagpur. Neterhat, elev. 3500 ft! Parasnath, *Clarke*! Fl. March–April.

Leaves puberulous above, hairy on the nerves beneath, obtuse or subacute, base rounded, obtuse or cuneate. Petiole slender ·05–·13″. Lower whorls often slender-peduncled, distant. Nutlets elliptic-oblong, brown, minute, smooth.

2. **M. biflora,** *Benth.* Syn. Satureia biflora, *Briq.*; Thymus biflorus, *Ham.*; Indian Wild Thyme.

A small much branched wiry herb with numerous pubescent stems 3–10″ long from a woody rootstock, small sessile or subsessile elliptic or ovate or oblong gland-dotted leaves ·17–·25″ long and axillary short 2–4-fid. cymes of small pink flowers ·3″ long.

Rocky places and fire-lines, Chota Nagpur. Neterhat, 3000 ft. Fl., Fr. April–June. Perennial.

Stems pubescent in our specimens, sometimes glabrous (*F.B.I.*). Leaves with thickened entire margins and 3–4 very oblique fine sec. n. Petiole sometimes very short, with several long hairs at the base. Calyx ·12″, teeth setaceous, tube strongly nerved. Corolla with straight notched or 2-lobed upper lip and spreading 3-lobed lower lip. Stamens ascending, 2 lower longer, slightly exserted beyond the upper lip, anther-cells widely divaricate.

16. CALAMINTHA, *Mœnch.**

Herbs or shrubs with entire or toothed leaves and axillary, spiked or panicled whorls of flowers. Calyx 13-nerved, 2-lipped, upper lip 3-toothed, lower 2-fid, teeth narrower than of the upper; throat raked or villous. Corolla-tube straight, throat villous, upper lip erect, flattish; lower spreading 3-lobed. Stamens 4, 2 sometimes imperfect, ascending under the upper lip, anther-cells parallel or diverging. Style-lobes equal or the lower larger. Nutlets minute, subglobose, smooth, dry.

1. **C. umbrosa,** *Benth.*

Prain records this in *Bengal Plants* from Chota Nagpur, but I doubt the identification. A supposed specimen is on the right-hand side of the same sheet as one from N.W. India, and is marked "top of Parasnath." It is *not in flower* and is not in my opinion at all like *Calamintha umbrosa*, but is a flowerless specimen of *Micromeria capitellata*. The only other specimen similarly identified is one collected by *Campbell*, probably also on Parasnath, and is likewise *not in flower*. Although

* *Bentham* distinguishes *Micromeria* from *Satureia* mainly by the calyx being 13-nerved. But this is not always the case in our species, which may be only 11-10-nerved! This observation supports *Briquet's* view that *Micromeria* and *Calamintha* should be reduced to *Satureia*. He charges *Bentham* with inconsistency in splitting up *Satureia* while not similarly treating *Salvia*, *Hyptis* and other genera. But *Briquet* seems quite as illogical in reducing *Calamintha* to *Satureia* while maintaining distinct *Mosla* and *Perilla*—groups of the most striking generic similarity. The reduction of a pair of anthers in *Mosla* is a very insufficient character under the circumstances, rendered the poorer in that the degree of reduction is variable even in the same individual, while the only other character, that of a hairy throat to the calyx, occurs in some of his species of *Satureia* but not in others. *Calamintha* seems separable from *Micromeria* by the more zygomorphic calyx, though it would be perhaps better to include them both in *Satureia* were it not that that genus becomes unwieldy.

superficially more like *Calamintha umbrosa* than the first, this is also probably *Micromeria capitellata*.

17. SALVIA, *Linn.*

Herbs or shrubs. Flowers often large, red, blue or yellow, rarely white, in usually interruptedly racemed or spicate whorls. Calyx tubular or campanulate, with entire or 2-toothed upper, and 2-fid lower lip; throat naked. Corolla-tube naked or with a ring of hairs inside; upper lip erect, lower 3-lobed, lateral lobes spreading. Stamens 2 perfect, filaments short, jointed on a slender connective which bears 1 or 2 perfect cells. Disc tumid behind. Style ascending 2-fid. Nutlets 3-quetrous, smooth.

1. **S. plebeja,** *Br.*

An erect copiously regularly branched herb with square stems 1–2 ft. high, wrinkled sage-like ovate, oblong, or ovate-lanceolate crenate leaves 1–3″ long and terminal often panicled racemes of small or minute white-lipped flowers in 6-fid. whorls. Upper calyx-lobe decurrent on the tube as in *Ocimum* but elliptic, lower 2 teeth longer acute, others obsolete. Stamens ascending under the upper lip, cells widely separated by the lever-like connective, one imperfect.

Usually in gravel near streams. Champaran! Purneah, *Cal. Herb.*! Singbhum! Manbhum, *Cal. Herb.*! Fl. Feb.–March.

Stems grooved on the sides, pubescent with short reflexed hairs. L. narrowed into the rather long petiole, lower usually obtuse, upper more acute. Racemes 2–4″, glandular. Bracts oblong or lanceolate and smaller ones under the lateral flowers. Corolla ·12–·17″ only, upper lip concave 2-toothed, lower spreading 3-toothed with the central much larger, white with few brown dots, all teeth rounded, throat with a small ring of hairs within.

Several beautiful species are in cultivation but most of them only thrive in the hills. **S. coccinea** *L.*, is commonly grown in gardens in the plains. It has long lax erect spikes of scarlet flowers about 1″ long and will often seed itself.

18. NEPETA, *L.*

Herbs. Flowers often small, blue, white or yellow in axillary and terminal sometimes spicate or racemed whorls. Calyx tubular, 15-ribbed, regular, equally 5-toothed or 2 lower teeth narrower. Corolla-tube not annulate within, throat inflated, upper lip straight, notched or 2-fid, lower 3-fid, midlobe largest. Stamens 4, ascending under the upper lip or exserted, upper pair longer; anther-cells diverging. Style-lobes subulate. Nutlets smooth.

1. **N. hindostana,** *comb. nov.* Syn. Glechoma hindostana, *Roth.* (1821); N. ruderalis, *Ham.*

An aromatic herb with one or many stems 6–18″ high from the root, obtusely 4-cornered and pubescent. Leaves somewhat nettle-like but small, lower about 1·25 by 1″ ovate or broadly ovate, coarsely crenate-serrate with petiole ·5–·75″. Flowers blue-purple ·25″, in stalked axillary dense cymes aggregated at the top of the stem into dense spiciform thyrses ·8″ diam., peduncles of lower cymes often ·3″. Fruiting calyx ·25″ ribbed, slightly curved, with oblique mouth, 2

lower subulate teeth rather smaller and narrower than the three upper. Nutlets oblong, light brown with white dots, and small basal attachment areole.

In damp places! Darbhanga, *Cal. Herb.*! Patna, *Madden*! Behar, *Kurz*! Palamau, *Gamble*! Sant. Par., *Wall*! Ramgarh Ghats (Hazaribagh), *Prain*!

My description is taken from specimens collected on the Vindhyan Plateaux lands west of our area where it is frequent, and it will therefore be almost certainly found on the Chota Nagpur *pats*. Fl., Fr. March–June.

Leaves on small plants sometimes only ·5″ long, on large ones 1–2″, usually hoary-pubescent, usually very obtuse, base sometimes cordate, both sides hairy. Bracts setaceous. Flowers hairy pedicelled. Corolla lower lip ·2″ with a large shovel-shaped emarginate and slightly obtusely crenate midlobe and narrow paler-coloured 2-fid side lobes, throat purple spotted. Longer stamens with very divergent anther-cells slightly exceeding the flat pale-coloured 2-fid oblong hairy upper lip.

19. ANISOMELES, *Br.*

Erect branching coarse herbs. Flowers purplish in axillary whorls or lax flowered branched panicled cymes. Calyx ovoid or tubular, straight, equally 5-toothed. Corolla with short tube annulate with a ring of reflexed hairs within, upper lip erect entire, lower broad, spreading, midlobe notched. Stamens exserted, anthers conniving, of the longer pair 1-celled, of the shorter 2-celled, cells transverse parallel. Style subequally 2-fid. Nutlets smooth.

1. **A. indica,** *O. Ktze.* Syn. A. ovata, *R. Br.*

A strong smelling softly pubescent herb 3–6 ft. high with ovate coarsely crenate acuminate leaves 1–3″ long and purplish flowers in axillary dense-flowered whorls and terminal spikes, or whorls laxly cymose elongate.

Champaran to Purneah, common! Santal Par., common! Chota Nagpur, frequent! Angul, *Chattarjee*! Probably in all districts. Fl., Sept.–Nov. Fr. Dec.–Jan.

Leaves from sparsely pubescent to woolly beneath. Calyx ·3″ hirsute within and without, teeth acuminate. Corolla with pale or greenish nearly flat entire upper lip and lower purple spreading 3-lobed lower lip with the midlobe laterally compressed and notched. Filaments purple-bearded or only slightly hairy. Nutlets ·05–·16″ black, polished.

20. SCUTELLARIA, *L.*

Herbs or undershrubs. Flowers in axillary whorls, or whorls spiked or racemed, sometimes only 1–2-fid. Calyx 2-lipped closed in fruit, upper lip with a broad peltate or concave scale on the back and finally deciduous when the nutlets are ripe. Corolla with a long tube, usually sharply recurved from the base and erect, not annulate within, upper lip entire or notched, lower broad 3-lobed. Stamens 4, anthers conniving, ciliate, lower 1-, upper 2-celled. Disc elongate. Ovary oblique; upper style-lobe short. Nutlets very minute, smooth granulate or hispidulous.

1. **S. discolor,** *Colebr.*

Leaves chiefly radical or subradical, petioled, rosulate orbicular or oblong, crenate, rounded at apex, cordate at base, larger 3″ by 2·5″, pubescent on the strong nerves beneath and often purple. Stem with raceme 6–15″ with few distant pairs of sessile orbicular cordate or elliptic leaves ·5″ long, sometimes with an axillary branch or raceme. Flowers violet-blue with lighter coloured lip, ascending,

·5″ long. Upper corolla-lobe hooded, concealing the anthers, lateral erect with revolute margins, lower lip subquadrate retuse ·2″ long. Nutlets disclosed after fall of the upper calyx lip, 4, brown, turbinate, granulate and minutely glochidiate seated on the oblique receptacle and anterior side of the elongated disc.

Wet banks. Neterhat, elev. 3000 ft. ! Fl., Fr. Sept.–Jan.
Stems and racemes minutely pubescent, glandular above. Racemes very lax. Flowers solitary or opposite, subsecund, pedicels about ·1″ equalling the linear-oblong bract. Calyx-lips entire rounded, shield exceeding the upper lip.

21. LEONURUS, *L.*

Erect leafy stout herbs with the leaves cut or lobed. Flowers in axillary dense-flowered whorls with subulate bracts. Calyx 5-nerved, turbinate with 5 spreading spinescent teeth. Corolla-tube naked or annulate within, upper lip entire erect, hooded or flattish; lower 3-fid with obcordate midlobe. Stamens 4, anthers conniving, cells transverse. Style-lobes obtuse or subulate. Nutlets 3-quetrous, truncate, smooth.

1. L. sibiricus, *L.*

Rather a handsome herb 3–5 ft. high, with square stems and long-petioled pinnati-partite or palmi-partite leaves with linear-lanceolate segments again incised, lobes linear. Flowers red, ·5″ long, with spinescent calyx ·25″ long and upper lip of corolla hooded tomentose; mid-lobe of lower lip spreading, side-lobes erect, tube not annulate within.

Chiefly in the North-West districts, in hedges. Bettiah! Muzafferpur! Fl., Fr. Dec.–March. Doubtfully indigenous. Annual.
Stems and branches (in our area) hoary tomentose. Leaves hoary beneath. Bracts acicular. Nutlets ·1″ long, glabrous.

22. LEUCAS, *Br.*

Herbs or undershrubs, nearly always pubescent or villous. Flowers usually white in axillary whorls rarely crowded and terminal. Calyx 10-nerved, striate, or ribbed (at least above), with regular or oblique mouth, equally or unequally 6–10-toothed. Corolla-tube included, sometimes annulate within, upper lip erect concave or hooded, villous on top; lower spreading, 3-fid with very large midlobe. Stamens 4, ascending under the upper lip, anthers conniving, cells divaricate, finally confluent. Style subulate, the posterior lobe being obsolete. Nutlets ovoid, 3-quetrous, obtuse.

I. Calyx membranous reticulate, mouth split above, oblique:—
  Erect with pubescent stems and coarsely serrate leaves . . 1. *urticæfolia.*
II. Calyx neither membranous (at least above) nor reticulate, mouth not split:—
  A. Calyx-mouth regular, not villous, teeth small. Bracts inconspicuous, setaceous, villous. Whorls all axillary:—
    1. Hairs suberect and spreading:—
      Stems and leaves tomentosely-hairy. Leaves ovate . 2. *lanata.*
      Stems and leaves with short erect and long spreading hairs; leaves oblong-lanceolate . . . . . 3. *helicterifolia.*
    2. Hairs reflexed:—
      L. subsessile or short-petioled. Whorls densely 6-20-fld. Fls. subsessile . . . . . 4. *montana.*
      L. with slender petioles. Fls. 1-3 distinctly pedicelled . 5. *procumbens.*

B. Calyx-mouth oblique. Bracts mostly as long as calyx :—
1. Calyx-mouth with erect villi (few and short in 10), teeth ·05–·2″ long, usually slender (exc. in 9) :—
a. Whorls terminal only or few also axillary in upper axils :—
i. Hairs both short deflexed and longer spreading :—
* Bracts filiform ·3–·4″ long, hairy :—
Calyx ·4″, teeth ·06–·2″ . . . . . 6. *stricta.*
Calyx ·25″, curved, teeth ·1″ . . . . 7. *Clarkei.*
** Bracts lanceolar, ·25–·3″ long :—
Calyx ·3–·4″, sharply curved; teeth ·05-06″ . 8. *nutans.*
ii. Hairs uniform, spreading :—
Whorls 1–2″ diam., terminal. Upper calyx-teeth projecting far beyond the very minute lower . 9. *cephalotes.*
b. Whorls numerous. Hairs short reflexed :—
Leaves lanceolate 1–3″. Calyx curved ·5–·7″ . . 10. *martinicensis.*
2. Calyx-mouth not villous, lower part of tube sometimes membranous. Teeth mostly under ·05″ :—
Calyx glabrous ·2–·25″, teeth very minute . . . 11. *hyssopifolia.*
Calyx membranous below, ribbed and hispid above, ·3–·45″, upper teeth ·03–·05″ . . . . . 12. *aspera.*
Calyx scarcely ribbed upwards, glabrous, or slightly pubescent above, ·2–·3″, teeth very small, sometimes only 7 . . . . . 13. *linifolia.*

1. L. urticæfolia, *Br.*

An erect hairy herb with square pubescent stems 1–2 ft. high and nettle-like ovate to lanceolate coarsely obtusely serrate leaves 1–2·5″ long. Flowers white in very dense globose whorls ·7–1″ diam. supported by linear or subulate-lanceolate hirsute bracts ·3–·5″ long. Calyx membranous, reticulate, ·4–·5″ long with very oblique mouth, split above, ribs produced into spinulose teeth.

Patna, *Madden*! Fl., Fr. Dec.-March.

A very distinct species. L. softly pubescent beneath with 4–5 raised sec. n., base sometimes shortly suddenly cuneate on the ·3–·8″ long petiole.

2. L. lanata, *Benth.*

Woody below with many stems 8–18″ from a stout stock, densely woolly-tomentose all over or (in our variety) indumentum of longer less woolly hairs, always spreading or suberect (cp. *montana*). Leaves 1–2″ ovate, rounded or obtuse, crenate, base sometimes subcordate. Lower petioles up to ·5″ long, uppermost leaves subsessile. Whorls sessile dense. Calyx ·22–·25″, ribs excurrent as linear unequal teeth ·09″ or less, tube shortly finely sericeous within except at base. Corolla ·3–·35″, tube included, lower lip ·2″.

The typical plant has not been found in our area and is Himalayan. Var. *nagpurensis* occurs on Parasnath (see below). Var. *candida* occurs on the hills of the Central Provinces, and is easily distinguishable by the beautiful dense pure white tomentum and broadly ovate rounded leaves, larger flowers and calyx-teeth up to ·09. It appears to me to be separate from true *L. lanata* and also from the Parasnath plant. It possibly occurs on the higher Sirguja mountains. Fl., Fr. Oct.-Dec.

Var. nagpurensis, *C. B. Clarke.*

Stems sometimes ·2″ diam. at base. Leaves ovate to lanceolate-ovate subacute densely sericeous-tomentose beneath and less so above, rather coarsely and obtusely serrate or dentate-serrate, sec. n. 3–5. Whorls 10–20-fld. Calyx with minute subulate teeth only ·01″ long. Corolla ·3″, upper lip contracted at base, suborbicular above, shorter than the lower. Calyx sericeous within one-third of the way down.

Except in the direction of the indumentum this looks more like a variety of *L. montana* than of *L. lanata* or *L. candida* (*mihi*).

3. **L. helicterifolia,** *Haines. Kew Bulletin*, 1922, 6, p. 188.

A herb with suberect 4-angled stems 2–3 ft. long densely covered with erect and spreading hairs. Leaves oblong-lanceolate 1·5–2·5″ long by ·4–·7″ broad, distantly serrulate or denticulate, closely appressed-villous both sides, subsessile or with petiole up to ·2″. Flowers white, ·5″ long, sessile, in dense 4–10-fld. whorls with filiform villous bracts ·1–·2″ long. Calyx obconic ·3″ long, appressed-villous outside, thinly hairy within on the upper third, 10-ribbed, ribs ending in minute triangular very acute or sub-spinulose teeth. Corolla-tube exserted ·1″, upper lip densely bearded on the margins about as long as the glabrous lower lip.

Common on the sandstones of the Ramnagar Hills! Fl. Nov.–Dec.
The hairs have swollen bases.

4. **L. montana,** *Spreng.* Syn. Phlomis montana, *Roth.* Inc. L. mollissima, *Wall.*; L. Hamiltoniana, *Wall.*; L. pilosa, *Wall.*, in part (2058 B); Gitil a: or arak, *K.*, *S.*

A herb with stems sometimes woody below, usually numerous from a woody rootstock, 8″–2 ft. long, suberect or diffuse or clambering through undergrowth to a height of 4 ft, softly tomentosely-hairy with reflexed hairs or thinly reflexed-hairy. Leaves ovate or broadly ovate, more rarely lanceolate-ovate, crenate or serrate, usually sericeo-lanuginous beneath, villous above, 1–1·5″ long, usually very shortly petioled. Whorls rather dense of 6–14 sessile white flowers. Bracts very inconspicuous. Calyx ·25″ obconic, densely hairy, with regular mouth and 10-ribbed tube terminating in as many minute linear or subulate teeth.

Very common in rocky jungles and waste ground, especially in the hills, in all districts of the Central and Southern Areas! Fl., Fr. c.s. and h.s.

Bentham describes the flowers as "white? but oftener purple," but they are *always* white. The calyx is sometimes glabrous within but usually more or less shortly silky in the upper third. Corolla ·4–·5″, tube exsert in the type, often included, lower lip with lateral small recurved lobes and large broad terminal spreading centre lobe.

There are all manner of transitions between the following forms, which can scarcely even rank as varieties:—

(*a*) **montana,** proper (*Wall. Cat.* 2056, 2525).

Branches tomentose, leaves shortly petioled, under 1·2″, ovate, very obtuse, crenate, sericeo-lanuginous beneath, villous above. Calyx sericeo-tomentose.

Parasnath, *Clarke*! Kalahandi plateau, but with leaves less obtuse!

(*b*) Var. **mollissima.** Syn. L. mollissima, *Wall.* (No. 2054).

Rootstock very woody. Branches diffuse reflexed hairy (*Wallich, As. Pl. Rar.*, i, p. 62, calls it tomentose). Leaves subsessile, ovate, ·7–1·5″,

rugose, crenate, densely lanuginous or hairy beneath. Whorls many-fld. or rarely few-fld., bracts minute, setaceous. Calyx ·24″, the setaceous teeth up to ·04″ villous. Corolla-tube exsert, upper lip ·15″, lower ·2″.

The type is from Nepaul, and probably occurs in our Northern Area.

(*c*) Var. **pilosa.** Syn. L. pilosa, var. pubescens *Benth.* (*Wall.* 2058 *B*).

Differs from var. *mollissima* in the larger acute leaves 1–2·5″, tomentosely hairy beneath, thinly hairy above, hairs with thickened bases, coarsely dentate-serrate and somewhat tapering. Petiole ·1–·3″. Calyx ·3–·35″ with teeth the longest of all the varieties ·05–·1″

Rajmahal, *Wall*!

(*d*) Var. **Hamiltoniana,** *Wall.* (No. 2525).

Stems retrorsely hairy. Leaves 1-1·5″, lower with petioles ·35″ long, ovate to ovate-lanceolate, crenate to serrate, sericeous beneath, hairy above. Calyx ·25″, sometimes slightly curved, teeth very minute. It is less diffuse than *mollissima*. *Wallich* says that it differs by the much larger leaves (!), by the whorls scarcely 6-fld., by the longer calyx sub-incurved.

Monghyr Hills, *Ham.*!

(*e*) Var. **scaberula,** *J.D.H.* Syn. L. mollissima, var. scaberula, *F.B.I.*

Not at all tomentose and calyx somewhat hispid-hairy. Hairs on leaves thin and sparse. L. 1–2·5″ coarsely dentate-serrate. Calyx teeth up to ·04″.

All districts of Chota Nagpur, a common form!

(*f*) Var. **parvifolia,** *Haines.*

A very pretty form with lanceolate or ovate-lanceolate leaves only ·4–·75″ long, hairy both sides and very numerous whorls. Fls. 8–10 in a whorl shortly pedicelled. Calyx ·2″ long nearly glabrous within with deltoid, spinulose-tipped teeth.

Angul, *Chattarjee*!

The leaves of *L. montana* and its varieties are eaten as a pot-herb.

5. **L. procumbens,** *Desf.*

A laxly branched procumbent herb with stems 2–3 ft. long from a woody rootstock, slender, nearly glabrous. Leaves lanceolate (elliptic-ovate, *F.B.I.*), ·75–1·5″, rather membranous, entire or remotely serrate, base cuneate on a slender petiole one-third as long as the blade. Flowers white in whorls of 1–3 only, pedicelled. Calyx ·3″ obconic, 10-nerved and with 10 equal subulate small teeth ·05″ long, tube nearly glabrous, teeth pilose or glabrescent.

Waste ground, Palamau! Not common. Fl., Fr. Oct.–Dec.

Angles of branches thinly appressed hairy or puberulous. Leaves substrigose or puberulous on the nerves beneath and very thinly hairy above, sec. n. 2–4 slender. Pedicels of flowers slender ·15–·25″ long, often abruptly curved.

6. **L. stricta,** *Benth.*

Erect or diffuse with 4-grooved and -angled stems clothed with long and very short hairs, with very distant pairs of linear to elliptic leaves ·5–1·5″ and several leaves close to the inflorescence. Whorls in a terminal and sometimes also one median head. Bracts many long linear-filiform rigid, long-ciliate, ·3–·4″. Calyx ·4″ with the teeth ·06–·2″, longer than the villi at the mouth.

Orissa, sand dunes near the coast, *Beng. Pl.* But this appears to be one of the species included in Orissa from occurring in Ganjam (Madras Presidency).

Leaves with long hairs both sides, beneath also pubescent and glandular. The two forms with narrow linear and shorter elliptic leaves are superficially very different. Calyx shortly closely pubescent in flower, somewhat glabrescent.

7. **L. Clarkei,** *Hook. f.*

Very similar to the linear-leaved form of *L. stricta*, but calyx shorter, ·25″, curved and closely densely pubescent, teeth ·1″ hispid, mouth very densely villous.

Parasnath, *Clarke*! Fl. Nov.

Leaves sometimes remotely toothed. Seeds oblong ·1″.

8. **L. nutans,** *Spreng.*

Very diffuse and not unlike the broader-leaved form of *L. stricta*. Hairs long spreading and shorter deflexed. Leaves ·5–1·5″ oblong or narrowly-oblong, closely serrate or subserrate, obtuse, with long hairs on the nerves beneath and short ones between. Petiole very short. Whorls often 2–3 on a branch, terminal with a crown of leaves. Bracts lanceolate, ·25–·3″. Calyx hispid-hairy on the teeth, ·3–·4″ long, sharply curved about the middle, teeth subulate ·05–·06″.

Parasnath, *Clarke*! Topchanchi (Hazaribagh, and near Parasnath), *Wood*! Fl. Nov.

9. **L. cephalotes,** *Spreng.* Andia durap arak', *S.*

An erect herb 1–2·5 ft. high with 4-grooved patently hairy stems, elliptic-lanceolate (ovate or ovate-lanceolate, *F.B.I.*) remotely crenate-serrate leaves 1·5–2·5″ long, and dense subglobose terminal (or subterminal, being usually surmounted by a pair of leaves) whorls 1–2″ diam., closely invested by a large rather membranous lanceolate or elliptic and acuminate aristate bracts ·5–·7″ long which are rigidly ciliate and with a few stiff hairs on the back.

Exceedingly common in cultivated fields, less so in waste land. Darbhanga, *Cal. Herb.*! Santal Par.! All districts of Chota Nagpur! Probably throughout the whole area but, as in the case of many common weeds, not often recorded. Fl., Fr. Sept.–Dec. Annual.

Leaves softly shortly pubescent and with longer hairs beneath and more evidently punctulate than in many of the genus, sub-strigosely hairy above, sec. n. 3–5. Petiole ·1–·3″ long. Bracts strongly nerved. Calyx tubular ·6–·75″ long, hairy above, mouth bearded, oblique, ribs 10 ending in 10 sub-aristate hispidulous teeth ·04–·06″ long. Corolla-tube shortly exserted, lower-lip ·22″ slightly longer than the densely white-bearded upper lip.

The leaves are eaten as a pot-herb. "The seeds yield a medicinal oil," *Campbell.*

10. **L. martinicensis,** *Br.*

Usually leafy 2–3 ft. high with many heads. Stems with numerous reflexed short hairs. Leaves lanceolate 1–3″, slightly serrate, closely

hispid-hairy both sides. Whorls numerous globose ·6–1″ diam. with linear spinulose-tipped hairy bracts. Calyx sigmoidly curved ·5–·7″ long, nearly glabrous or finely pubescent below, pubescent above and with spinescent teeth, the uppermost much the longest, ·15–·2″.

Hazaribagh, *Clarke*! Sirguja, *Clarke*! Fl. Oct.–Nov.

11. **L. hyssopifolia,** *Benth.*

A very hispid herb from a woody stock, with linear leaves in distant pairs below, closer above, upper pairs each with a dense globose whorl ·5–·7″ diam. (without corollas) supported by narrowly linear hispid-ciliate spinulose bracts ·2–·25″ long. Calyx glabrous ·2–·25″ long with minute mucroniform teeth.

Sambalpur, *Griffith*! Chota Nagpur (*Bengal Pl.*) is apparently an error copied from the *F.B.I.* Fl., Fr. May–July.

Stems with stiff spreading or suberect hairs. Leaves 1–2·5″, stiffly hairy both sides especially on the midrib beneath, subsessile, margins sometimes recurved and sec. n. *nil* but sometimes a slender nerve parallel to midrib. Calyx with wide mouth, obconic. Corolla-tube scarcely longer than calyx, pubescent above, upper lip ·15–·2″, lower lip ·4″.

12. **L. aspera,** *Spreng.*

Annual, erect or diffuse with stems much branched 8″–2 ft., deeply grooved, thinly hairy; shoots densely hairy. Leaves linear, narrowly oblong, lanceolate-oblong or rarely narrowly elliptic, 2–3″, tapering to a short petiole, crenate-serrate or subentire, thinly pubescent or shortly hairy both sides, sec. n. 2–4. Whorls terminal and axillary, often a single terminal or two close together, ·7–1″ diam. with numerous linear hispid-ciliate bracts ·3–·5″ long, sub-spinulose tipped. Calyx ·3–·45″, tubular with very oblique mouth and teeth ·03–·05″ long, only ribbed above, smooth below, throat pubescent or glabrous. Corolla lower lip ·35″, upper ·15″.

In cultivated fields. Behar, common, *Hope, Hooker*! Patna, *Madden*! Ranchi, *Gamble*! Manbhum, *Clarke*! Fl. Fr. July–Jan.

13. **L. linifolia,** *Spreng.* Gumar, Dulphi, *Vern.*

Erect 1–3 ft. high with 4-grooved usually much branched softly pubescent (or "hispid," *F.B.I.*) stems, linear or linear-lanceolate, entire, or remotely shallowly crenate-serrate, leaves 2–4″ long and dense axillary and terminal whorls of white sessile flowers with linear setaceous bracts ·15–·25″ long. Calyx ·2–·25″ (–·3″, *F.B.I.*) with very oblique mouth, the upper part projecting far beyond the lower, teeth very small, sometimes spinulose, tube not or only faintly ribbed.

A common field weed, also in pastures and waste ground. Purneah! Darbhanga, Burkill! Chota Nagpur, common! Probably in all districts, but badly represented in herbaria. Fl., Fr. c.s. *Annual.*

Stem lined. L. usually about ·15–·3″ broad (rarely ·75″, *F.B.I.*), minutely pubescent both sides or somewhat scaberulous above, acute or obtuse, sec. n. 3–4. Petiole 0–·3″ passing gradually into the base of the leaf. Whorls towards the ends of the branches, ·5–·75″ diam. Calyx somewhat obovoid, glabrous or closely puberulous, teeth about 7 or sometimes (*fide F.B.I.*) calyx 2-lipped with upper 3-toothed lip and lower 2-fid lip. Corolla-tube included. Nutlets dark-brown, ·08″ oblong, 3-quetrous.

23. LEONOTIS, *Br.*

Tall herbs or shrubs with scarlet or yellow flowers in dense axillary whorls with many slender, sometimes spinescent, bracts. Calyx 10-nerved, often incurved with oblique mouth and 8–10 rigid teeth, the upper largest. Corolla-tube exserted, upper lip long concave with villous crown; lower very small, spreading, concave, midlobe largest. Stamens 4, ascending; anthers conniving, cells divaricate. Disc regular. Style subulate, upper lobe very short. Nutlets oblong or ovoid, 3-quetrous, obtuse or truncate, glabrous.

1. **L. nepetæfolia,** *Br.* Dare-dhompo, Janum-dhompo, *S.*; Konto-sidho, *Or.*

A rather handsome tall herb 4–7 ft. high, rather strict, with thick 4-angled and -grooved puberulous stems, large ovate crenate leaves 4–8″ long below, smaller more lanceolate and deflexed under the whorls, and large distant globose whorls 2–3″ diam. of scarlet flowers with spinescent bracts and calyx-teeth.

Usually near villages and not indigenous in our area. Frequent in Chota Nagpur! Angul! Fl. Oct.–Jan.

Petiole 1–3″, winged above. Bracts slender, linear. Calyx ·75″, upper lip ·25″ long spinescent, lower with 3 spinescent teeth, throat glabrous, outside pubescent. Corolla 1″ long with slender exserted tube, villous. Nutlets linear oblong, widening upwards, truncate.

24. TEUCRIUM, *L.*

Herbs or shrubs. Flowers in 2–6-fid. axillary whorls or terminal spikes, racemes or heads. Calyx 10-nerved, teeth 5 equal or the upper larger. Corolla-tube not annulate within; limb 1-lipped, the 2 upper and lateral lobes cuneate and very short or obsolete, lower lobe very large. Stamens 4, exserted, anther reniform, cells short, at length confluent. Disc regular. Style-lobes subequal. Nutlets minute reticulate, smooth or rugulose with large oblique or lateral hilum.

1. **T. stoloniferum,** *Roxb.*

Erect from a creeping base rooting at the nodes, with finely pubescent stems 12–22″ high, ovate coarsely deeply crenate leaves 2–3·5″ and numerous simple and terminal panicled racemes of small flowers ·2″ long. Corolla white tinged with purple.

It occurs in Oudh and Northern Bengal, *i. e.* both sides of and close to our area. It will probably therefore be found within it. Fl. Jan.–May.

Sweet-smelling. Leaves finely pubescent beneath, sec. n. 5–6, oblique. Calyx in flower ·1–·14″, pubescent; globose in fruit (upper part withering), ·08″ diam.

25. AJUGA, *L.*

Herbs with whorls 2–more-fld., axillary or in terminal leafy spikes. Calyx 10- or more-nerved, teeth 5 subequal. Corolla-tube often annulate within, upper lip very short 2-fid lower spreading 3-fid, midlobe usually the largest and notched or 2-fid. Stamens 4, ascending, exserted or included; anther-cells diverging, distinct or at length confluent. Disc regular, or produced behind. Ovary shortly 5-lobed with subequal style lobes. Nutlets obovoid, rugose when dry with the hilum lateral.

A. Corolla-tube widely cylindrical then suddenly bent or geniculate:—
L. usually serrate. Calyx-lobes obtuse. Lateral lobes of lower cor.-lip nearly as long as terminal . . . . 1. *macrosperma.*
B. Corolla-tube globose round the ovary or nutlets, then narrowed, straight. Calyx-lobes lanceolate:—
Spikes terminating in a woolly tip without conspicuous bracts. Cor.-tube shortly exserted . . . . . 2. *densiflora.*
Spikes terminating in long foliaceous bracts. Cor.-tube sometimes twice the calyx . . . . . 3. *bracteosa.*

1. **A. macrosperma,** *Wall.*

Stems 1–2 ft. long procumbent and often rooting, terete, shortly appressed-hairy or hairs thin spreading. Leaves elliptic or ovate with tapering base 2–6″ long including the petiole which is ·5–1·5″ (passing gradually into leaf base), coarsely usually doubly or unequally obtusely or subacutely serrate, rarely crenate membranous. Flowers ·27–·28″ long (to tip of upper cor.-lip) and ·16–·17″ wide (to tip of lower lip). Calyx ·22″ long, lobed not quite to middle, lobes rounded or obtuse, lower slightly longer. Corolla scarcely or not exserted with broadly tubular base to some distance above the ovary then suddenly humped and bent forward, lower lip with obdeltoid scarcely emarginate midlobe not much longer than the side lobes.

Growing in shady beds of nalas. Near Purneah! Singbhum! Parasnath! Fl., Fr. Jan.–March.

Stems usually villous towards inflorescence, usually grooved. Leaves shortly thinly hairy both sides, subobtuse. Spikes 3–9″, at first very dense, subsequently interrupted, bracts oblong reflexed, lower foliaceous, upper inconspicuous. Calyx thinly hairy, delicately 10-nerved. Corolla hairy and glandular, azure blue or violet, upper lip with two short oblong lobes. Stamens decurved then erect, exserted. Nutlets oblong, nearly ·1″ long and about half as broad, rugose and reticulate when dry.

2. **A. densiflora,** *Wall.* Syn. A. bracteosa, var. densiflora, *F.B.I.*

Stems decumbent and ascending 6″–1 ft. high from a very woody rootstock, obtusely 4-sided, with dense spreading pubescence. Leaves mostly elliptic-oblong, 3–6″, base usually somewhat tapering, repandly or sinuately dentate or lobulate or subentire, lower petioles ·2–·3″, upper leaves often sessile. Flowers ·25–·27″ long to tip of upper lip (or nearly ·5″ if measured to lower lip) and ·25″ wide (to tip of lower lip). Calyx ·18–·2″ long, lobed halfway, lobes lanceolate acuminate. Corolla slightly exserted, base globose round the ovary or fruit but contracted immediately above them and tube straight or only slightly bent; lower lip with broadly obovate 2-lobed midlobe ·2–·25″ broad and ·25″ long, side-lobes oblong shorter inclined forward.

Moist places. Higher hills of Chota Nagpur. Neterhat! Fl., Fr. May–Oct. Bettiah (see next species)?

Stoloniferous from the woody stock. Whole plant often with a purple tint. Indumentum said to be variable. Leaves in our area velvety or pubescent beneath especially on the nerves, sparsely hairy (gradually glabrescent) above, tip rounded. Spikes 3–8″, at first very dense, lower whorls finally discrete, dense bracts ·4–·5″ or lower foliaceous, upper rhomboid pubescent and hairy. Calyx campanulate, hairy, rather membranous and indistinctly nerved, often pink. Corolla sparsely hairy outside, pink, or white with pink veins, upper lip short erect 2-lobed or subentire. Stamens exserted, tip of filaments incurved. Nutlets globose-oblong, ·06–·1″ long and nearly as broad, smooth and shining when fresh, rugose and pitted when dry.

3. **A. bracteosa,** *Wall.*

This differs from *A. densiflora*, which, however, is perhaps correctly reduced to a variety of it in the *F.B.I.*, by the very long spreading bracts of the spike which exceed the whorls and terminate the spike. It also differs in the much more exserted corolla-tube, which is sometimes nearly twice as long as the calyx. Upper lip of corolla erect 2-fid.

A specimen from Bettiah, *Hieronymus*! is named *A. bracteosa* at Kew, but I think it is *A. densiflora*; it is somewhat fragmentary.

THE

BOTANY OF BIHAR AND ORISSA

An Account of all the Known Indigenous Plants of the Province and of the Most Important or Most Commonly Cultivated Exotic Ones

By

H. H. HAINES, C.I.E., F.C.H., F.L.S.

Late Conservator of Forests, Bihar and Orissa

Published under the Authority of the Government of Bihar and Orissa

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Made and printed in Great Britain.

NEW YORK
BOTANICAL
GARDEN

DIVISION III.—APETALÆ.

FAM. 107. NYCTAGINACEÆ.

Herbs, shrubs or trees with usually opposite, entire, exstipulate leaves. Flowers small or mod.-sized, sometimes showy or often showy from being subtended by an involucre of coloured leaves, at other times minute in heads, cymes or umbels, which are sometimes panicled. Perianth or calyx gamophyllous, petaloid with the tube persistent and accrescent, limb 3–5-lobed, plaited in bud. Petals 0. Stamens 8–30, hypogynous, sometimes unilateral, filaments usually unequal, inflexed in bud, anthers didymous. Ovary free, 1-carpellary, 1-celled, style involute in bud with simple or multifid stigma. Ovule 1, erect, between anatropous and campylotropous. Fruit a thin-walled achene, enclosed in the hardened perianth-tube. Seed erect, albuminous, with the embryo curved or spiral, or straight with folded cotyledons, radicle inferior.

I. Flowers dicœcious, 1-sexual. Embryo straight with crumpled cotyledons :—
  Shrubs with opp. or alt. leaves and greenish cymose fls. . 1. *Pisonia.*
II. Flowers 2-sexual. Embryo hooked :—
  A. Climbing shrubs with alt. leaves and tubular fls. with a coloured involucre of large bracts . . . . . 2. *Bougainvillea.*
  B. Herbs :—
    Fls. showy, 1–3 in a calyx-like involucre . . . . 3. *Mirabilis.*
    Fls. small or minute in heads or umbels, bracts minute . 4. *Boerhaavia.*

1. PISONIA, *L.*

Trees or shrubs, sometimes spinous. Leaves opp. or alternate. Flowers inconspicuous, green, usually dicœcious and 2–3-bracteolate, in corymbose cymes. Perianth 5–10-toothed, funnel-shaped in male, tubular in female. Stamens 6–10, exserted. Ovary sessile, oblique with capitate or feathery stigma. Fruit with the hardened perianth nut-like. Embryo with crumpled cotyledons enclosing a scanty soft albumen.

1. **P. aculeata,** *L.*

A stout sarmentose shrub (sometimes climbing) with stout recurved thorns and opposite or subopposite sometimes fascicled leaves 1–3″ long, thinly pubescent beneath. Flowers green or greenish-white, males in close corymbose cymes, females in fruit in lax divaricate cymes easily recognised by the long-pedicelled 5-angled glandular-glochidiate clavate-oblong nuts ·3″ long.

Only in the south of Puri district and not far from the sea! Fl., Fr. Feb.–May.

Bark pale, smooth on the branches. L. obovate to narrowly elliptic and orbicular on same plant, shortly bluntly acuminate, sec. n. 3–5 weak, obliquely spreading. M. fl. ·1–·12″, funnel-shaped with 7–8 far exserted stamens. Fem. ovoid obscurely toothed. Fruiting pedicels ·5″ long. Nuts tomentose between the ribs.

2. BOUGAINVILLEA, *Comm.*

Large scandent thorny shrubs (or erect outside our area) with alternate leaves. Flowers somewhat coloured but rendered very

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conspicuous by each, or clusters of three, being supported by an involucre of 3 usually brilliantly coloured large bracts: when fls. 3-nate midrib of bract adnate to the pedicel, bract persistent and acting as a wing to the fruit. Perianth tubular with a spreading but small 5-lobed limb and a somewhat wider basal part which hardens into the leathery wall of the achene (nut or anthocarp), while the upper part becomes spirally rolled. Stamens 5–10, very unequal, scarcely exsert. Stigma linear. Cotyledons somewhat unequal.

A South American genus of which several varieties are now common in Indian gardens.

1. **B. spectabilis,** *Willd.*

Branchlets and leaves both sides pubescent. Leaves orbicular-ovate acuminate. Flowers and bracts ternate at the ends of every branchlet and forming immense panicles of a deep magenta colour. Perianth greenish-yellow.

This and the next are the commonest *Bougainvillea* found in nearly every large Indian garden and often climbing over tall trees. Fl. Feb.–April.

2. **B. glabra,** *DC.*

Branches and leaves glabrous, spines shorter. Leaves lanceolate. Bracts of a less deep magenta, sometimes said to be pale-pink. It flowers two or three times in the year.

Horticultural catalogues also distinguish between *B. lateritia* with brick-red flowers and *B. splendens* with pinky-purple flowers. These are not entered in the Kew Index and appear to be merely garden varieties of *B. spectabilis*.

3. MIRABILIS, *L.*

Herbs often with tuberous roots and m.s. or somewhat large flowers clustered on the branches of large leafy panicles, each or clusters of 2–10 surrounded by a calyx-like involucre of 4–5 connate bracts. Perianth brightly coloured, salver-shaped to campanulate. Stamens 3–5, rarely 6, somewhat exserted. Nut ellipsoid or ob-pyramidal, often ribbed or rugose. Cotyledons large suborbicular on germination.

Chiefly Central American plants, or if the genus *Oxybaphus* be included, then one Himalayan species.

1. **M. jalapa,** *L.* Marvel of Peru; Four o'clock Plant.

A well-known herbaceous plant 1–2·5 feet high with large perennial tuberous roots, rather fleshy stems and cordate leaves. Flowers usually purple but very numerous colours are found and the perianth is sometimes variegated. There is only one flower to the involucre in this species, which latter therefore is apt to be mistaken for a calyx.

Very common and often spontaneous in Indian gardens.

2. **M. longiflora,** *L.* Sweet-scented Marvel of Peru, has white flowers with a very slender tube over 3″ long.

4. BOERHAAVIA, *L.*

Herbs with opposite leaves and small or minute flowers jointed on their pedicels, capitate, umbelled or panicled. Bracts small, rarely

forming a minute involucre. Perianth with long or short tube and funnel-shaped 5-lobed limb. Stamens 1–5, exserted. Ovary oblique, stipitate, stigma peltate. Nut small glandular. Cotyledons broad, thin, incumbent, enclosing a soft scanty albumen.

Fls. sessile or subsessile in heads. Leaves in the pairs unequal . . 1. *diffusa*.
Fls. in umbels with slender pedicels. Leaves equal in each pair . 2. *repanda*.

1. B. diffusa, *L.* Syn. **B. repens,** *L.* Ohoic' arak', *S.*

A rather succulent diffuse herb with rusty-puberulous stems and broadly ovate leaves, usually whitish beneath, in unsymmetrical pairs, the larger attaining 2″ by 1·75″. Flowers very small, rose-coloured, sessile or nearly so in heads or small umbels on slender peduncles from the leaf axils and in axillary and terminal panicles. Perianth with limb plaited in bud, campanulate, tube constricted above the ovary and glandular, lobes emarginate. Stamens 2–3. Fruit ·12″ long, clavate, 5-ribbed, glandular.

Very common in grassy waste places! Probably in all districts. Fl., Fr. r.s.
Somewhat resembles *Trianthema monogyna* (to which it may be allied). L. with obtuse or subcordate base, apparently green beneath in typical *diffusa*, white beneath in forms *repens* and *procumbens*. The latter form is said to have glabrous branches 2-3 ft. long with larger, broader, more rounded leaves and more panicled inflorescence than in *repens* which has branches 6–10″ only, appressed-pubescent, leaves small, ovate or oblong, often acute.
Leaves eaten as a pot-herb, and the root given in diarrhœa, dysentery and cholera, *Campbell*. Root laxative, diuretic and stomachic, *Dutt*.

2. B. repanda, *Willd.*

A diffuse or subscandent herb with long pale glabrous (in our specimens) or pubescent (*F.B.I.*) branches, and ovate repand or lobed or sinuate, acute or acuminate leaves 1–2·5″ long. Flowers pink, ·3–·4″ diam. with slender pedicels ·3–·5″ long in long-peduncled axillary umbels mostly from one axil of the pair only. Fruit narrowly clavate, ·25–·3″ long, ribbed, glandular.

Monghyr, *Ham.*! Puri! Khandpara State! Fl., Fr. Aug.–April.
Leaves sometimes unequal in the pairs with rounded, truncate or subcordate base. Petioles ·5–1·5″. Peduncles slender, exceeding the leaves, 3-6-fld. Perianth-tube ·25–·35″ long, only part round ovary swollen and with minute white hairs, limb only ·17″ diam. according to *F.B.I.* Stamens far exserted.

FAM. 108. AMARANTACEÆ.

Herbs, rarely shrubs or undershrubs with opposite or alternate exstipulate simple and usually entire leaves. Flowers small, green or coloured, of chaffy consistency, sometimes polygamous or 1-sexual and usually collected into dense heads or spikes, the outer in a cluster or head sometimes imperfect and altered, heads or spikes often panicled, bracts and 2 bracteoles nearly always present and chaffy or scarious like the perianth. Tepals 5 persistent, imbricate in bud. Stamens, 1–5 opposite the tepals, filaments free or connate below or united with intervening membranous staminodes into a hypogynous cup; anthers 1–2-celled, pollen spherical with numerous pores. Ovary superior, usually free, rarely fused with the perianth in fruit, formed of 1–3, rarely more carpels but always 1-celled. Styles 0–3,

rarely 4, stigmas capitate or feathery. Ovules 1, rarely (Celosieæ) several, camplotropous, erect basilar or pendulous from a slender basilar funicle. Fruit a utricle, rarely a berry or capsule or a nut, sometimes enclosed in the perianth. Seed compressed, testa crustaceous. Embryo annular or horseshoe-shaped, albumen mealy.

I. Ovary 2-many-ovuled. Leaves alternate:—
  Sarmentose shrub. Fruit baccate . . . . . 1. *Deeringia.*
  Herbs. Fruit a membranous utricle . . . . . 2. *Celosia.*
II. Ovary 1-ovuled. Leaves alternate or opposite:—
  A. Ovule erect. Leaves alternate:—
    1. Flowers 2-sexual:—
      Flowers capitate. Fruit circumsciss . . . . 3. *Allmania.*
      Flowers spicate. Fruit a nut . . . . . 4. *Digera.*
    2. Flowers 1-sexual:—
      Flowers in axillary and spiked clusters . . . 5. *Amarantus.*
  B. Ovule suspended from a slender basal funicle:—
    1. Anthers 2-celled:—
      a. Flowers without staminodes, in clusters of 1-3 perfect and several imperfect and altered. L. opposite . . . . . 6. *Pupalia.*
      b. Flowers with staminodes, without accessory deformed and imperfect ones:—
        Sepals hyaline woolly. L. alt. or opposite . . 7. *Ærua.*
        Sepals shining, one or all spinescent, fls. deflexed 8. *Achyranthes.*
    2. Anthers 1-celled. Leaves opposite:—
      St.-tube short. Stigma capitate, subsessile . . . 9. *Alternanthera.*
      St.-tube long. Stigma 2-fid on long style . . . 10. *Gomphrena.*

1. DEERINGIA, *Br.*

Rambling or climbing shrubs with alternate leaves and small 1–2-sexual flowers, in simple or panicled spikes. Tepals 5, scarcely scarious, spreading in fruit. Stamens 4–6, connate at the base, anthers 2-celled. Ovary sessile or shortly stipitate with a short style and 2–4 stigmatic branches. Ovules many on long funicles. Fruit baccate. Seeds few or many.

1. **D. baccata,** *Moq.* Syn. D. celosioides, *Br.*; Celosia baccata, *Retz* (1779); Gaulmauni, *Beng.*

A rambling or subscandent shrub with long arching branches, ovate or ovate-lanceolate acuminate petioled leaves 2–5″ long and small greenish-white flowers in numerous panicled spikes 3–6″ long. Very pretty in fruit when it bears an abundance of small scarlet globose somewhat 3-gonous berries, each with a few black seeds.

Champaran, common in open riverain mixed forest! Purneah, common! Monghyr, *Ham.*! Palamau, scarce, near the Sone River! Fl. Sept. Fr. Nov.–Jan.

Glabrous. L. with rounded or acute base and 7-9 arching sec. n. Flowers 2-sexual (in my specimen) with small subulate bracts about as long as the very short pedicels and ovate bracteoles. Tepals linear-oblong, ·08″ long. Disc annular. Stigmas 2–4. Berry ·2″ diam.

The berries have a somewhat bitter taste.

2. CELOSIA, *L.*

Herbs with alternate leaves. Flowers white or pink, shining; clustered or spicate. Perianth of 5 scarious striate or ribbed tepals. Stamens connate into a cup at the base, anthers 2-celled. Disc very

short. Ovules several. Fruit a circumsciss utricle. Seeds erect, lenticular.

Spikes usually tapering. Fls. over ·25″. Leaves linear or lanceolate. . . . . 1. *argentea.*
Spikes often fasciated. Fls. under ·25″. L. often ovate. . . var. *cristata.*

1. C. argentea, *L.* Inc. C. cristata, *L.*; Sirgit-arak', *S.*; Sirwari, *Kharw.*

An erect glabrous herb 1–3 ft. high with linear or lanceolate acuminate leaves mostly 1–2″ but attaining 6″, and peduncled cylindrical, ovoid or lanceolate shining pink or white spikes mostly 1–3″ long, sometimes attaining 8″ (*F.B.I.*). Tepals mostly ·25–·3″ long, very scarious, with the similar but smaller bract and bracteoles often aristulate. Seeds several small black shining.

Usually in cultivated fields. Purneah, frequent! Monghyr, *Kurz*! Ranchi and other districts of Chota Nagpur, frequent and ascending to the top of Parasnath! Angul, *Lace*! Very widely distributed in India and probably occurs in all districts of our province. Fl., Fr. Aug.–Dec. Annual.

Stem and branches angled and striate. L. with base cuneate or tapering into the slender petiole; sec. n. 5–7 very slender. Spikes at first usually acute and tapering with short peduncles, subsequently peduncles elongating, often branched, and old spikes often obtuse or rounded or sometimes even branching into a cock's-comb form.

Var. **cristata.** Syn. C. cristata, *L.*

Leaves often broad, sometimes up to 9″ by 2″. Flowers smaller. Spikes very often excessively developed and monstrous as in the well-known garden "Cock's comb," which in cultivation gives also yellow flowers.

3. ALLMANIA, *Br.*

Herbs with alternate leaves, and flowers in axillary and terminal globose or ovoid dense heads. Tepals 5, scarious, acuminate, striate. Stamens 5, connate below into a cup, anthers 2-celled. Ovary ovoid with slender style and capitellate stigma. Ovule 1 erect. Fruit a circumsciss utricle. Seed erect with a small cupular aril and annular embryo. Cotyledons linear flat.

1. A. nodiflora, *Br.*

A diffuse branched sub-succulent herb with stems 12–18″ long, linear or linear-oblong, sessile or shortly petioled, leaves and sessile leaf-opposed yellowish-green heads of flowers ·5–·75″ diam. Stamens 5 erect with pink anthers. Capsule membranous, circumsciss and disclosing the single black shining minutely puberulous seed seated on an inflated membranous aril.

Ranchi and Hazaribagh (Damuda Ghats)! Manbhum, *Camp.*! Angul, *Chattarjee*! Fl., Fr. Aug.–Sept. (see variety).

This is apparently the type or *Hooker's* variety *angustifolia*. The leaves are 2–4″ long and sessile, acute or obtuse. The heads are congested cymes with the flowers subsessile, tepals ·2″ long sharply or pungently acuminate, scarious with green pubescent midrib. Bracts linear aristate, hispid.

Var. **Roxburghii,** *J.D.H.*

A procumbent herb with obovate leaves only ·5–1″ long. Heads as above.
On sand, Balasore! Fl. May. Probably at other times also.

4. DIGERA, *Forsk.*

An annual herb with alternate leaves and small flowers in spikes, or in reality very contracted panicles, each bract bearing in its axil a flower and 2 bracteoles and the bracteoles again mostly bearing an abortive flower in their axil. Tepals 4–5, outer larger 5–9-nerved, inner 2–4-nerved. Stamens 5, rarely 4, free or scarcely connate at the base, anthers 2-celled. Ovary broadly oblong truncate, style filiform with 2 short recurved stigmas. Ovule erect. Fruit hardened. Seed globose with thin crustaceous testa adhering to the albumen. Embryo annular, cotyledons linear.

1. **D. alternifolia,** *Aschers.* Syn. D. arvensis, *Forsk.*; Achyranthes alternifolia, *L.*; Kari-gandhari, *S.*

An erect or prostrate herb 1–2 ft. high with glabrous or very thinly minutely hairy branches. Leaves mostly ovate or elliptic or some lanceolate 1–2″, rarely 3″, obtuse or acute rather pale and somewhat ciliolate on the nerves beneath. Spikes of small pink flowers axillary, slender, becoming rather lax in fruit, 1–5″ long, long-peduncled. Bracts boat-shaped, ·07–·08″ long, bracteoles nearly as long, keeled. Outer 2 tepals covering the rest, lanceolate-oblong acute, ·13–·15″ long. Nut ·075″ diam., globose, slightly compressed, rugulose, falling with the perianth and bracteoles together with the accrescent abortive florets, but leaving the somewhat reflexed bracts.

A common weed in Singbhum! and Manbhum, *Camp.*! Possibly in all districts. Fl., Fr. r.s.

Leaves variable in shape and often with very small ones on the lower part of the stem or from the axils of the larger; sec. n. 6–9, distinct beneath, arched, usually 2 from base. Petiole slender somewhat hairy ·5–2″. The abortive flowers are small rather fleshy 2-fid scales during the flowering period, they then increase in size, become bifurcate with each branch again forked or toothed, and then attain ·1″. It is in this state that they have been described as "crested scales."

The plant is used as a pot-herb.

5. AMARANTUS, *L.*

Annual herbs, sometimes spinous, with alternate leaves and green or red small 1-sexual flowers in clusters which may be axillary or in erect or drooping, sometimes panicled spikes. Tepals 5 or 1–3. Stamens 1–5, free, anthers 2-celled. Ovary compressed, style short or 0, stigmas 2–3 filiform or subulate. Ovule 1 erect. Utricle compressed indehiscent or circumsciss, tip sometimes 2–3-toothed. Seed orbicular, compressed, testa crustaceous. Embryo annular with linear cotyledons.

I. Spinous. Tepals of M. acuminate, of F. obtuse apiculate . 1. *spinosus.*
II. Unarmed. Tepals of M. and F. usually similar:—
  A. Flowers 5-merous. Styles 2–3. Utricle circumsciss:—
    1. Bracts longer than the tepals:—
      L. acute or acuminate. Tepals oblong-lanceolate, acuminate . . . . . 2. *paniculatus.*
      L. with obtuse tip. Tepals obovate-mucronate . . 3. *caudatus.*
    2. Tepals longer than the bracts:—
      L. obtuse or emarginate. Tepals acute or subaristate 4. *giganteus.*
  B. Flowers 2–3-merous:—
    1. Bracts and tepals awned, longer than the circumsciss utricle:—

Erect, usually stout. L. up to 5″ and more. Clusters sometimes in terminal spikes . . . . . 5. *gangeticus.*
Diffuse. L. ·25–1·7″. Clusters all axillary . . . 6. *mangostanus.*
2. Bracts and tepals not awned:—
a. Erect. Clusters often spicate. Utricle prominently rugose or sub-echinate, circumsciss . . . 7. *viridis.*
b. Erect or diffuse. Clusters all axillary. Utricle not or slightly rugose, often indehiscent:—
L. under 2″, ovate to ell.-lanceolate. Tepals 3. Utricle globose with obtusely conical tip . . 8. *blitum.*
L. ·3–·7″, obovate. Tepals 3. Utricle ovoid rugose . 9. *polygamus.*
L. ·2–·5″, narrow-oblong. Tepals 2. Utricle longitudinally furrowed, indehiscent . . . . 10. *tenuifolius.*

1. **A. spinosus,** *L.* Januma, *Ho.*; Janum-ara, *M.*; Kanta-natia, *Beng.*

An erect glabrous copiously branched weed, 1–2 ft. high, armed with sharp axillary spines. Leaves ·25–4″ long, ovate, lanceolate or rhomboid. Flowers green, in axillary clusters and clusters also in long terminal erect and also axillary more or less spreading spikes.

Waste ground and cultivation, very common! Throughout the province. Fl., Fr. most of the year.

Stem smooth, green, red or striped. Leaves with base narrowed into a slender petiole, margin often crisped or waved. Spines attaining 1″, very sharp. Bracts narrow, shortly awned, exceeding the sepals Sepals with a green midrib and scarious margins, of male acuminate, of female obtuse apiculate. Stamens 5. Fem. fl. with 2–3 distant stigmas. Seed dark brown or black.

The leaves are eaten. The ash of the plant is used as a dye, *Camp.*

2. **A. paniculatus,** *L.* Syn. A. frumentaceus, *Ham.*; Larka baha, *S.*

A large variously-coloured robust annual with stems often 1″ diam. or more at base, erect with very numerous erect branches, 2–7 ft. high with a panicle of one foot or more. Leaves ovate, elliptic or sub-rhomboid-elliptic, 2–5″ long, scarcely acuminate, minutely dotted beneath; sec. n. fine but prominent, about 10, not including the shorter intermediate. Spikes ·3–·4″ diam., the centre one 4″ and more with innumerable shorter lateral ones spreading at right angles, and with those of the branches together forming a large thyrsoid panicle, with acicular recurved bracts very much longer than the oblong-lanceolate sharply acuminate sepals.

Frequently cultivated! Bhagalpur (*Wall.* 6903 *a*)! Manbhum, *Camp.*!

The perianth and stems are often a bright claret-purple. Stems glabrous, usually deeply channelled and ridged. Utricle somewhat rugose. Seeds black or (in var. *frumentaceous*) white. *Roxburgh* describes them as pellucid with a callous white margin.

3. **A. caudatus,** *L.* Syn. A. cruentus, *Willd.*; Inc. A. alopecurus, *Hochst.*; Gandari, Ba Leper a:, *Kol.*; Love-lies-bleeding.

Less robust than the last with stems more regularly grooved, very long-petioled narrowly elliptic or elliptic obtuse leaves 2–5″ long, with 7–10 sec. n. Panicle far less dense, branches or spikes 1–3″, distinct, ·15–·2″ wide, or if the panicle is thyrsoid branches subequal 3–4″ (exc. var. *alopecurus*). Bracts acicular, longer than the obovate mucronate sepals.

Singbhum! Sambalpur, *Cal. Herb.*! Fl., Fr. r.s.

Stems often reddish striate. Leaves sometimes rhomboid, sometimes concave, midrib often excurrent. Petiole often as long as the blade. Perianth segments hyaline, ·04″. Utricle hyaline circumsciss about the middle. Seeds in the type usually white or yellow with thick rounded border.
Eaten as a *sag*.

Var. **alopecurus ;** Love-lies-bleeding.

Whole panicle inclined or drooping with a very long drooping terminal and innumerable small subequal lateral spikes. Crimson or yellow. Seeds usually lenticular and pitch-black with a compressed border.
The well-known garden plant, often cultivated. The two kinds of seed are said to be found on both varieties.

4. **A. giganteus,** *König,* ? Marang leper a :, *K.*

A very stout coarse herb attaining 8 ft. with striate, slightly appressed pubescent stems and ovate or ovate-lanceolate leaves often 9″ by 4·5″ obtuse or emarginate and apiculate, base acute or rounded, nearly glabrous, sec. n. about 10 strong. Petiole 3–5″, slightly scabrid. Flowers crowded in axillary and terminal dense spikes ·75–1″ long, these in narrow panicles 3–9″, the short spikes spreading at right angles from the main rhachis. Male flowers 5–6-merous, tepals acute or sub-awned, longer than the bracts.

Cultivated in Singbhum! Fl. r.s.
The above is from my notes, but I have kept no specimens. It may be *Roxburgh's* third variety of *A. oleraceus*. It can hardly, however, be a variety of *A. gangeticus*. The short bracts preclude its being *A. paniculatus* or *caudatus* unless it is a variety of one of these.

5. **A. gangeticus,** *L.* Syn. (according to the *F.B.I.*) A. tristis, *L.* ; A. tricolor, *L.* ; A. oleraceus, *Roxb.* ; A. polygamus, *Roxb.* ; A. lividus, *Roxb.* ; Khara, Vern., Ara-leper-a : (when red), naguri-leper-a : (when white), *K.* ; Lal Sag, *H.* ; Dengua, raknashak, etc., *Beng.*

An erect, often stout herb 1–3 ft. high or sometimes up to 5 ft., green, bright-pink or (esp. in the garden *A. tricolor* variously) often brilliantly coloured. Leaves long-petioled broadly deltoid-ovate, or some also oblong or lanceolate, the lower often 5″ by 4″, sometimes larger ; base suddenly narrowed and decurrent on the 2–3″-long petiole, apex obtuse or emarginate. Clusters of minute green flowers congested in the axils, rarely also in a few simple spikes, never in large panicles. Bracts ·12–·17″ long, hyaline lanceolate to oblong-oblanceolate (or subulate, *F.B.I.*), awned. Tepals usually 3 in the male and 2 in the female, awned like the bracts. Utricle smooth circumsciss.

Largely cultivated. Singbhum! Manbhum! No doubt in most districts, bu not recorded. Fl., Fr. Sept., Feb., May, probably all the year.
Tepals mostly narrowly lanceolate with green midrib excurrent as the awn, nearly always 3 with 3 stamens in the male and 2-3 styles united at base in the female. Seeds black with acute border.

If the synonymy given by the *F.B.I.* (reproduced above) is correct, the plant is very variable, the following being distinguished by *Roxburgh* as species :—

Var. *α.* **tristis.** Syn. A. tristis, *L.*

Erect, very ramous near the ground. L. rhomb.-oval, emarginate. Clusters axillary and in terminal spikes. Tepals subulate, ending in an awled joint, longer than the utricle.

Annual, cultivated and held in great esteem by the natives. It differs from *oleraceus* in having long diffuse branches from the base. It may be cut several times while *oleraceus* only yields one crop. *Roxburgh.*

Var. *β.* **lividus.** Syn. A. lividus, *Roxb.*; Gobura-nati, *Beng.*

Erect, smooth, simple, 2-3 ft. L. sub-ovate, retuse. Clusters axillary and in a terminal spike. Tepals 3–5, obtuse, shorter than the round compressed utricles.

I doubt this being a variety of *A. gangeticus*. The short obtuse tepals are quite different.

Var. *γ.* **oleraceus.** Syn. A. oleraceus, *Roxb.*, not *L.*; Sada-natia, *Beng.*

Erect with a few branches above the middle. L. from broad-rhomboidal to ovate-lanceolate. Clusters axillary and on a terminal spike. Tepals cuspidate and rather longer than the rugose utricles.

Roxburgh enumerates a red and a white variety of this and also a variety which he says is *Konig's A. giganteus* 5-8 ft. high and as thick as a man's wrist (see species 4).

Var. *δ.* **tricolor.** Syn. A. tricolor, *Willd.*

L. variously coloured, rhomb.-lanceolate. Clusters axillary, half amplexicaul. Tepals cuspidate, longer than the utricles. Fl., Fr. whole year.

Var. *ε.* **melancholicus.** Syn. A. melancholichus, *Willd.*

Erect, ramous, 6-12 ft. high. L. remote, rhomb.-ovate, coloured. Fl. and Fr. of last.

Var. *ζ.* **polygamus.** Syn. A. polygamus, *Roxb.*, non *L.*; Chamli sag, *H.*; Champa natia, *Beng.*

Diffuse or erect in good soil. L. rhomb.-ovate emarginate. This is possibly *A. mangostanus* (*q.v.*).

6. **A. mangostanus,** *L.* Syn. A. polygamus, *Roxb.* ?

Diffuse with rhomboid often very small leaves ·25–1·7″, tapering at the base, rarely attaining 2·3″, obtuse, sec. n. about 6. Petiole slender, as long as blade. Clusters of flowers all down the stem, rarely forming a feeble terminal spike.

Ranchi, *Clarke*! Gya, *Nusker*!

Fresh plant all green according to *Clarke*. It is very distinct in its general habit and appearance. Bracts awned. Tepals lanceolate awned, longer than the utricle.

7. **A. viridis,** *L.* Jangli-chaurai, *H.*; Huring lepera a :, *K.*

A slender herb 1–2 ft. with somewhat the habit of *A. spinosus*, green, glabrous. Leaves ovate, rhombic-ovate or rhomboid, ·7–3·5″, but usually 1–2·5″, with base somewhat decurrent on the slender petiole. Flowers very minute in spikes 2–3″ long and ·2–·3″ broad, often few and distinct on the panicle, in other cases fairly numerous and forming a denser panicle. Tepals 2–3 linear to oblanceolate (ovate-oblong, *F.B.I.*), hyaline with a green keel not at all aristate, mostly quite muticous, ·05–·06″ long and bracts even shorter. Utricle very rugose, ·06–·07″ long, acute, indehiscent.

Patna, *Wall.* (No. 6901*a*)! Monghyr, *Ham.*! Ranchi, *Wood*! Singbhum, common! Probably in all districts. Fl., Fr. r.s., March, May, possibly throughout the year. Cultivated like the others as a *sag*.

The markedly rugose fruits and muticous tepals easily distinguish it.

L. not or very indistinctly dotted, sec. n. about 5.

Roxburgh says eaten but not cultivated. His *A. fasciatus* is a variety with a pale crescentic band across the leaf.

8. **A. blitum,** *L.*

Stem grooved, erect or procumbent with more of the habit of *A. mangostanus*, the lower part of the stem being often leafless and ending in a terminal crown of leaves without terminal spikes or panicle. Leaves small, ·5–1·5″, rarely 2″, dotted, ovate to elliptic-lanceolate, obtuse retuse or emarginate, long-petioled with 5–7 sec. n. Clusters of flowers cymose. Flowers minute. Tepals 3, linear-oblong or -lanceolate, muticous or apiculate, ·06″ long, hyaline, bract scarcely longer. Utricle globose with short obtusely conical tip, membranous, circumsciss. Seed orbicular, deep red or shining black, margins acute.

Throughout India according to the *F.B.I.* and in the Western Provinces of Bengal according to *Bengal Plants*, but I see no specimens either at the Calcutta Herbarium or at Kew from our area.

The *F.B.I.* also gives a variety (*A. oleraceus*, L.) described as tall, succulent, with ovate, oblong or rounded leaves, clusters axillary and in terminal spikes, utricle indehiscent.

9. **A. polygamus,** *L.* Syn. A. polygonoides, *Roxb.*

A small species with many erect and diffuse branches 4–8″ long. Leaves obovate or oblanceolate rounded, ·3–·7″ long, tapering at the base into a slender petiole, dotted beneath or not, sec. n. 5–6. Clusters all axillary. Tepals 3, ending in a fine point. Utricle ovoid rugose, about equalling the tepals, dehiscent or not.

Gya, *Clarke*! Fl. Dec. A widely spread species occurring commonly in upper India, in Northern Bengal and in northern Madras. It is therefore probably frequent in our province although so little collected.

Roxburgh says that the branches are often coloured on the upper side, the leaves often emarginate with a minute bristle in the sinus, apex of utricle red, seed shining black. It is a wild species, but like others, used as a pot-herb.

10. **A. tenuifolius,** *Willd.*

A small species having somewhat the appearance of *Polygonum plebejum*, with very many diffuse branches from the rootstock 3–9″ long and narrow-oblong small leaves ·2–·5″ long, rounded at the apex and tapering into the slender petiole, sec. n. 2–3. Clusters all axillary, very small. Tepals 2 in the male, *Roxburgh* says 1–2 and often irregular in the female. Utricle as long as tepals, coloured and longitudinally furrowed, not dehiscent. Seed lenticular with obtuse border.

Patna, *Ham.*! Fl. April–June.

6. PUPALIA, *Juss.*

Herbs or undershrubs with opposite leaves and perfect and imperfect flowers mixed together in spiked (contracted paniculate) clusters, the imperfect reduced to awns with stellately spreading hooked bristles. Sepals 5, herbaceous, acuminate, 3–5-nerved. Stamens 5,

nearly free below ; anthers 2-celled. Ovary ovoid, with slender style and capitellate stigma. Ovule 1, pendulous from a long basal funicle. Utricle membranous ovoid, compressed, indehiscent, top areolate.

Herbaceous. L. nearly glabrous. Hds. small under ·5″ . . 1. *atropurpurea.*
Undershrub. Leaves tomentose. Fruiting hds. ·5′ . . . 2. *lappacea.*

1. P. atropurpurea, *Moq.*

A herb with long straggling branches, distant pairs of petioled shining leaves 1–4″ long and about 2 perfect flowers in a cluster ·25–·3 diam. in fruit, together with imperfect flowers developing in fruit into stellately spreading red hooked bristles.

Waste ground, edges of fields and grassy jungles, common. Purneah! Chota Nagpur, all districts! Puri, *Hooper*! Probably in all districts but not often collected. Fl., Fr. Nov.–Jan.

Stems often decumbent and rooting.

Branches glabrous or roughly pubescent. L. ovate, rhomboid or elliptic acute, apiculate, narrowed into the ·2-1″-long petiole, shining both sides, often thinly hairy above; sec. n. 4–6 slender and reticulate. Spikes with woolly rhachis, reaching 1 ft. in fruit, bracts pungent. Short pedicels and base of sepals woolly. Sepals also woolly at sides, sparsely hairy on back, pungent, 3-nerved ovate-lanceolate ·17–·2″ long. Seeds ·1″, oblong-ellipsoid with sub-truncate ends.

2. P. lappacea, *Moq.*

A pubescent or tomentose, scarcely woody, undershrub with long straggling branches, softly pubescent or tomentose ovate, ovate-oblong or lanceolate leaves 1–4″ long. Conspicuous in fruit from the barbed heads attaining ·5″ diam. which tenaciously adhere to the clothes and consist of few perfect flowers and about 3 imperfect with stalked stellate spines, the whole on a tough pedicel in the axil of a bract. Imperfect flowers yellowish.

Chiefly in rocky places. Monghyr Hills, *Kurz*! Santal Parg.! Palamau! Fl. Sept.–Oct. Fr. Nov.–Dec.

Branches tomentose. L. acute, obtuse or rounded, often apiculate, mature usually thinly hairy above but persistently sub-tomentose beneath, sec. n. about 4 or 5. Petiole ·1–·25″ only. Spikes tomentose 2–8″ long, with ovate aristate bracts persistent after the fall of the cymules (clusters). Imperfect flowers with about 4–7 spines in a whorl. Tepals ·2″ lanceolate, aristate, 3-nerved, woolly. Seed ·1″ ellipsoid compressed, smooth, shining, black.

7. ÆRUA, *Forsk.*

Woolly herbs or undershrubs with alternate or opposite leaves and small or minute flowers in woolly solitary clustered or panicled spikes, 2-sexual or often polygamous. Tepals 4–5 short membranous, all or the inner only woolly. Stamens 4–5, connate below together with alternate staminodes into a cup ; anthers 2-celled. Style with capitellate or 2-fid stigma. Ovule 1 pendulous from a long basal funicle. Utricle indehiscent or the coriaceous crown circumsciss. Seed inverse, testa coriaceous, embryo annular.

Spikes axillary and terminal, often panicled. L. 1–6″ long . . 1. *scandens.*
Spikes all axillary. L. ·5–1″ long. Broad . . . . . 2. *lanata.*
Spikes all short terminal. L. acicular ·5–1″ . . . . . 3. *Monsonia.*

1. Æ. scandens, *Wall.* Naria, *Beng.* ; Silwari, *Kharw.*

A straggling, scarcely scandent herb or undershrub, rarely more than 4 ft. high. Leaves mostly alternate, membranous, attaining in

robust forms 6″ by 2·25″, sometimes only 1″, elliptic, elliptic-lanceolate or lanceolate and usually tapering both ends, appressed-silky or shortly hairy beneath and more thinly so above. Fls. white in dense oblong panicled ovoid heads or cylindrical spikes ·25–2″ long, or terminal sometimes up to 4″. Tepals 2 mm. long, densely white-villous, outer white, inner with green centre. Stamens united below into a green cup with yellow anthers, staminodes shorter than the stamens. Style slender, stigmas capitellate.

Rocky jungles. Singbhum! Ranchi! Hazaribagh! Palamau! Angul, *Chattarjee*! Kalahandi! Probably throughout the Central and Southern Areas. Fl., Fr. Oct.–May. Perennial.

I have never seen this truly climbing though it sometimes clambers a few feet among bushes. The stems are often rather woody below and attain ·5″ diam. in exceptional specimens. Branches striate, often reddish on one side, minutely white-hairy or pubescent or sub-tomentose upwards, or those of the panicle villous. Leaf base usually decurrent on a short petiole rarely attaining ·5″, sec. n. about 8 on the largest leaves. Inflorescence generally of many short sessile irregularly placed spikes lateral on a leafless rhachis which terminates in a more elongated spike, sometimes lax below. Flowers often 4-5 on short lateral branches of the spike (which is really compound), each subtended by a hyaline shortly awned bract ·08″ long exactly resembling the woolly or villous ovate imbricate tepals. Flowers 2 sexual (or polygamous?). Staminodes often reduced to teeth. Style about as long as ovary, together about ·04–·05″ long. Capsule thin, rupturing irregularly more or less transversely.

2. Æ. lanata, *Juss.* Chaya, *Beng.*; Lopong arak', *S.*

A suberect, diffuse or prostrate herb with branches more hoary-villous than in the last species, and small obovate or rounded leaves ·25–1″, hairy or villosely tomentose both sides. Spikes ·25–·5″, usually clustered at the axils and only appearing spicate where crowded at the ends of new branches with immature leaves. Sepals 1·3 mm. as in the last species or (*teste F.B.I.*) obtuse. Stigmas minute oblong.

A common weed, usually in open village lands. Monghyr, *Ham.*! Gya, *Clarke*! Chota Nagpur! Probably in all the drier districts of the province, but very poorly represented in herbaria. Fl., Fr. Nov.–Jan.

The leaves are eaten as a pot-herb. Roots used medicinally, *Camp.*

3. Æ. Monsonia, *Mart.*

An erect or somewhat diffuse herb with woolly or cottony grooved and ridged stems and opposite branches and opposite or fascicled filiform or acicular 3-nerved leaves ·5–1″ long. Flowers rose-coloured in short cylindric spikes solitary and terminating all the branches, the main stem also ending in a solitary spike. Perianth ·08–·1″ long, woolly at base, tepals lanceolate-subulate. Utricle with small circumsciss top. Seed brown shining.

Open ground under Sal, Hazaribagh! Sambalpur, *Griffith*! Fl., Fr. Nov.–Jan.

Very rarely somewhat diffuse in our area, but in other provinces it is sometimes very diffuse with stems 2–3 ft. long from a long flexuous woody root. Spikes ·3–·7″ long, regularly disposed. Tepals usually 4. Stigma capitate subsessile.

8. ACHYRANTHES, *L.*

Herbs with opposite leaves and green or purplish flowers which are soon deflexed, in simple or panicled spikes with spinescent or awned bracts and usually also awned bracteoles. Tepals 4–5, subu-

late-lanceolate, one or all aristate, shining, hardened and strongly ribbed in fruit. Stamens 2–5, filaments connate at the base with intermediate quadrate staminodes which are toothed, or have a toothed dorsal scale, anthers 2-celled. Ovary oblong subcompressed with filiform style and capitellate stigma. Ovule pendulous from a long basal funicle. Utricle indehiscent, top areolate or rounded. Seed inverse, oblong, testa coriaceous. Embryo annular.

A. Outer (upper) sepal distinctly longer and narrower than the others, aristate, others muticous. Bracteoles not spinescent . 1. *aquatica.*
B. Sepals subequal. Bracteoles spinescent:—
Bracteoles ovate, awn not more than twice as long as blade . 2. *aspera.*
Bracteoles reduced to their awn which may be minutely auricled each side . . . . . 3. *bidentata.*

1. **A. aquatica,** *Br.*

A stout aquatic with thick decumbent and rooting stems and erect striate strigose branches terminating in the floral spikes. Leaves 2–6″, linear-lanceolate to elliptic-lanceolate, strigosely tomentose. Spikes with villous (or pubescent, *J.D.H.*) rhachis elongating to 8″ or 18″. Perianth with a thickened basal callus, outer (upper) tepal in fruit linear-subulate spinous-tipped, ·3–·35″ long, exceeding the 4 lanceolate shining coriaceous unarmed inner tepals. Fruit brown ovoid truncate, ·16″ long.

Jheels and tanks, Purneah! *Prain* says also Tirhut and Northern Bengal, but as there are no specimens in the *Calcutta Herbarium* he perhaps judges from its general distribution (Nepal Tarai to Assam, etc.). Fl. Sept.–Nov., Fr. Dec.–Jan. It is also a native of Coromandel, "straggling to a great extent about the edges of sweet water." *Roxburgh.*

Bracts ovate or ovate-lanceolate, ·13″, scarious. Bracteoles orbicular, membranous, short, embracing the hardened base of the perianth, not aristate. The flowers which fall with the bracteoles leave a hard callus at base of bract. Embryo enclosing a very mealy or granular albumen.

2. **A. aspera,** *L.* Sitir-Kadn, *M.*; Chipchirit, *S.*; Chirchira, Latjira, *H.*; Chirchiri, *Kharw.*; Apang, *Beng.*

An erect or subscandent herb with elliptic, obovate, or suborbicular, usually shortly suddenly acuminate leaves 1–5″ long, generally with close appressed hairs beneath, and long spikes of green polished deflexed flowers. Exceedingly troublesome in fruit from the spinous bracteoles and pungent pointed perianth which run into the hand and adhere to the clothes. The fruiting perianth, ·18–·2″ long, becomes detached, as in other species of the genus, together with the bracteoles, but leaving the reflexed bract. Bracteoles in flower with thickened base and broadly ovate membranous blade, the sharp excurrent awn not projecting more than the length of the blade, or at least the length of blade and base together. Tepals all lanceolate, outer with very pungent tips, base not hardened in fruit. Utricle broadly-oblong or slightly wider above, ·05″, top circumsciss.

Common, especially in the vicinity of villages, probably in all districts. Fl., Fr. Oct.–Jan.

Var. **porphyristachya,** *Wall.*, is subscandent and common in the forests with larger broadly elliptic acuminate more membranous leaves 3–6″ long, sometimes glabrous and therefore uniting this with

the next species. Whether it is really a variety or the differences only the result of its forest habitat is uncertain.

The leaves are eaten as a "sag" (pot-herb) when young. The ashes contain much potash. The plant is given in renal disorders.

3. A. bidentata, *Blume.*

A rambling herb distinguished from *A. aspera* (of which it appears to me to be merely a variety) by the blade of the spinous bracteoles being reduced to two minute auricles each side of the base of the spines, by the leaves being often much narrower elliptic to linear-lanceolate and glabrous or pubescent. The staminodes also are said to be toothed instead of fringed as in *A. aspera*.

Chiefly a hill plant. Parasnath, *Thomson*! But I have also seen it in the Duars and it may be in Purneah.

L. (cf Parasnath specimen) narrowly elliptic acuminate up to 5·5″ long, thinly shortly hairy. Auricles of bracteole distinct.

9. ALTERNANTHERA, *Forsk.*

Herbs, usually prostrate, with opposite entire or denticulate leaves and small white flowers in axillary often clustered heads. Tepals unequal, anterior and 2 posterior flattened, 2 lateral, innermost, concave. Stamens 2–5, filaments short, connate into a short cup with or without alternating staminodes; anthers 1-celled. Ovary with subsessile capitellate, rarely 2-fid, stigma. Ovule pendulous from a long basal funicle. Utricle compressed, ovoid, orbicular or obcordate, margins often winged or thickened. Seed inverse, lenticular with coriaceous testa. Embryo annular with narrow cotyledons.

1. A. sessilis, *Br.* Garundi arak', *S.*

A prostrate and rooting much branched herb, or sometimes subscandent among bushes and 3–4 ft. high, youngest branches with 2 lines of pubescence. Leaves narrow elliptic, linear-oblong, oblong-lanceolate or sometimes rhomboid ·5–2″, rarely in the damper districts up to 3″, sometimes denticulate, obtuse or rounded or in the rhomboid leaves acute. Clusters of flowers white or pinkish, the flowers when open up to ·1″ diam. pink at base and pearly white above. Tepals 1-nerved, glabrous, rigid, acute or very acute. Stamens 5 (always ?), of which 2–3 only or sometimes 5 are anther-bearing. Utricle compressed ·1–·12″ diam. obcordate with thickened margin.

In wet places. Purneah! Singbhum! Palamau! Manbhum, *Camp.* Fl., Fr. July–Jan.

Leaves narrowed at base into a short petiole. Nodes hairy, sometimes slightly hairy both sides, often rather fleshy, the larger-leaved form only seen in Purneah. Spikes or clusters ·25–·3″ long, rhachis and base of flowers woolly, and in the large-leaved form (possibly a distinct species) the sepals are hairy.

The leaves are eaten as a pot-herb.

FAM. 109. CHENOPODIACEÆ.

Herbs or shrubs often fleshy with simple alternate mostly entire exstipulate leaves, and small, often dimorphic 1–2-sexual flowers. Bracts occasionally absent. Perianth herbaceous or membranous,

persistent, often accrescent, of 3–5 free or connate tepals, imbricate in bud. Stamens usually one opposite each tepal in the male or 5, or sometimes fewer, hypogynous or perigynous, free or connate at the base, anthers 2-celled. Ovary 1-celled usually produced into a style with generally 2, more rarely 3–4, very seldom 5, stigmas which are usually narrow, seldom capitate. Ovule 1 camplotropous, with 1–2 integuments on a long or short basal funicle. Fruit usually a utricle, often enclosed in the enlarged sometimes fleshy perianth. Seed horizontal or vertical with coriaceous, crustaceous or membranous testa. Albumen floury, fleshy or 0. Embryo curved, annular or spiral.

Especially characteristic of desert or saline vegetation and often covered with silvery scales, but not well represented in our province.

I. Stem not twining. Bracteoles free from the perianth:—
  A. Stem not or not very fleshy. Leaves flat:—
    1. Flowers clustered, all similar:—
      Perianth 5-partite, not thickened at base . . . 1. *Chenopodium.*
      Perianth 5-lobed, base thickened fleshy . . . . 2. *Beta.*
    2. Flowers dimorphic. M. ebracteolate, 3-5-merous. Fem. enclosed in a pair of bracts usually without perianth:—
      Fem. fl. enclosed in a pair of bracts. Perianth 0 . . 3. *Atriplex.*
      Fem. fl. ebracteate. Perianth 3–4-toothed . . . 4. *Spinacia.*
  B. Stems fleshy or woody, leaves 0, or subterete and fleshy. Flowers very minute:—
    Flowers immersed in the fleshy jointed stem or spike . 5. *Salicornia.*
    Stem not jointed. Fls. axillary . . . . . 6. *Suæda.*
II. Stem twining. Bracteoles 2 broad adnate to the perianth . 7. *Basella.*

1. CHENOPODIUM, *L.*

Herbs with angled stems and alternate, entire lobed or toothed leaves, sometimes strong-smelling. Flowers very small, 2-sexual, in axillary clusters, spikes or cymes. Tepals 3–5. Stamens 1–5, hypogynous or subperigynous, free or connate below. Disc 0. Ovary free, depressed or compressed with 2–3 styles or stigmas. Utricle membranous, included in the scarcely altered perianth. Seed horizontal or vertical with crustaceous testa and floury albumen. Embryo annular.

Glabrous or with scurfy scales. Spikes dense axillary and in terminal thyrses. Stigmas 2 . . . . . 1. *album.*
Aromatic glandular. Spikes slender leafy. Stigmas 3 . . 2. *ambrosioides.*

1. **C. album,** *L.* Betua-sag, *Vern.*; Bhatua-arak', *S.*; Khartua-sag, *H.*

An erect or ascending herb 1–3 ft. high, green or in our area covered with minute scurfy scales. Leaves very variable, sometimes all under 1″ long, more or less oblong-lanceolate or rhombic-lanceolate; in some cultivated forms the lower ones attain 4–6″ long and rhombic deltoid or lanceolate, usually more or less toothed or lobulate, often irregularly. Petiole slender and generally as long as the blade. Flowers ·04–·05″ diam. in short axillary spikes and often forming also a terminal thyrse, mealy in our specimens. Tepals only slightly keeled, nearly covering the utricle. Seed black depressed with an obscure horizontal keel.

Champaran! Purneah, *Wall* (No. 6952 *d*)! A weed of cultivation in Manbhum, *Camp.*! Also seen in gardens in Singbhum, but it is also a European weed and may possibly be imported with vegetable seeds. Fl., Fr. March. Annual.

2. **C. ambrosioides,** *L.* Mexican Tea.

An erect pyramidal herb 2–4 ft. high with sulcate gland-hairy and minutely cobwebby pubescent stems. Whole plant with a peculiar rather strong subaromatic semi-pungent smell due to the glands. Leaves oblong or lanceolate, obtuse, lower sinuate-toothed. Flowers innumerable, minute, green sessile clustered and scattered along the numerous branchlets or slender spikes, and in the axils of small oblanceolate leaves, 4–5 or rarely 6-merous. Whole top of plant often converted into a leafy panicle.

Maldah, close to Purneah, *Clarke*! Banks of Ganges, *Kurz*! Edges of tanks, Ranchi! Fl., Fr. April–Aug. and perhaps other times.

Lower leaves 2·5″, coarsely toothed, oblong or lanceolate, smaller upward. Perianth 1·5 mm. diam. Tepals elliptic acute, connate at base, valvate, incurved. Stamens 4–6, hypogynous, 1·5 mm. long, filaments hyaline, anthers square. Ovary globose minutely papillose above, very minutely pedicelled. Stigmas 3–5 very minute. Two outer tepals with granulose glands, closed valvately over fruit. Seed depressed globose brown with copious albumen and embryo in a half-circle with linear cotyledons.

There has recently been a demand for this plant on account of the oil.

2. BETA, *L.* Beet.

Succulent herbs with alt. subentire leaves and 2-sexual flowers axillary and in axillary spikes or cymose clusters. Perianth urceolate, gamophyllous, 5-lobed, cohering in fruit by the enlarged hardened bases. Stamens 5. Disc fleshy, annular. Ovary depressed, sunk in the disc with short style and 2–4 subulate stigmas. Utricle adnate to disc and base of perianth. Seed horizontal with thin testa and floury albumen. Embryo annular.

1. **B. vulgaris,** *L.* Chakanda, *Vern.*

The well-known vegetable developing a large red root in cultivation with ovate or oblong obtuse leaves with cordate or cuneate base, cauline smaller upwards and often rhomboid or lanceolate. Spikes panicled, clusters of flowers distant with narrow acute bracts.

Widely cultivated in the cold season. The leaves are also used as a spinach. It is probably the same species as *B. maritima*, common as a sea-coast plant in Europe.

3. SPINACIA, *L.* Spinach.

Annual herbs with alternate leaves and dicœcious ebracteate flowers, the males in terminal spikes, the females in axillary clusters. Male sepals 4–5 herbaceous, free. Stamens 4–5. Fem. with subglobose 2–4-toothed perianth, coriaceous in fruit and sometimes with 2–3 dorsal spines. Stigmas filiform, connate below. Utricle enclosed in the perianth and adnate to it, hard, compressed. Seed vertical, testa thin, albumen floury. Embryo annular.

1. **S. oleracea,** *L.* Syn. S. tetrandra, *Roxb.*; Palak, isphani, pinnis, *Vern.*

There are two varieties of Spinach commonly grown in India. The prickly fruited with triangular or hastate variously lobed leaves and the smooth fruited

usually with more ovate or rounded leaves. The first is *Roxburgh's tetrandra*, the second perhaps always from European seed. Native country unknown but is believed to be derived from *S. tetrandra, Stev.*, which is indigenous in the Caucasus. Commonly cultivated in C.S.

4. ATRIPLEX, *L.*

Herbs or shrubs usually covered with silvery or scurfy small scales. Leaves alternate, rarely also lower opposite. Flowers monœcious or dicœcious, sometimes with a solitary 2-sexual intermixed, in clusters which usually form simple or compound spikes. Males without bracteoles, perianth 3–5-partite herbaceous or membranous, stamens 3–5. Fem. with 2 broad flat usually triangular sometimes toothed bracteoles, dilated in fruit and forming a 2-valved covering to the utricle; perianth 0. Stigmas 2. Utricle membranous enclosed in the hardened bracteoles. Seed erect, rarely otherwise. Albumen floury, embryo annular.

1. A. hortensis, *L.* Orache; Mountain Spinach.

A stout erect annual with striate glabrous stems, ovate obtuse, or upper sometimes triangular, leaves 2–2·5″ and slender panicles of greenish flowers, very conspicuous in fruit from the dry venose appressed orbicular-ovate or orbicular bracts ·3″ long.

Said to be cultivated in many parts of Bengal, but I find no specimens from our area either at Calcutta or Kew. Fl., Fr. Sept.

Leaves not mealy, lower sometimes triangular-cordate and sinuate-denticulate.

5. SALICORNIA, *L.*

Fleshy leafless jointed shrubs or herbs with minute 2-sexual flowers, 2–3 together sunk in pits at the joints of the branch-like spikes. Perianth turbinate or flask-shaped, 3–4-lobed or -toothed, spongy in fruit. Stamens 1–2. Utricle included, membranous, stigmas subulate. Seed erect, compressed, testa hispid with hooked hairs, albumen 0. Embryo conduplicate, radicle inferior, parallel to the folds of the cotyledons.

1. S. brachiata, *Roxb.*

An erect branched undershrub 12–18″ high. Branches many decussate with the joints clavate or showing an expansion at the tip, the floriferous branches or spikes very fleshy linear-spindle-shaped (not clavate) at the short joints, with 3-nate flowers on each side of all the nodes. Stamen 1 to each flower, extruded. Stigma 2-cleft.

On saline marshes or ground covered by the tides. Common near Calcutta, *Kew Herb.*! and the Chilka Lake, *Cal. Herb.*! Probably also in the intermediate Cuttack district. Fl. August.

6. SUÆDA, *Forsk.*

Herbs or shrubs, stem not jointed. Leaves fleshy usually terete. Flowers minute, axillary and running out into spikes, usually 2-sexual, bracteate and 2-bracteolate. Perianth short, 5-lobed or -partite, segments sometimes gibbous or subulate, equal or unequal. Stamens

5 short. Utricle included, membranous or spongy; stigmas 2–5, minute, subulate, recurved. Seed erect, oblique or horizontal, with crustaceous or coriaceous testa; albumen scanty or 0. Embryo plano-spiral.

Undershrub. Styles 3 . . . . . 1. *nudiflora.*
Herb. Styles 2 . . . . . 2. *maritima.*

1. **S. nudiflora,** *Moq.* Syn. Salsola nudiflora, *Willd.*

A woody branched undershrub 10–15″ high with branches spreading close to the ground, fleshy leaves ·25–·5″ long and very numerous flowers in clusters running out into terminal often panicled spikes bracteate in the lower parts. Styles 3.

Salt, barren lands near the sea from Calcutta southwards. Chilka Lake, *Cal. Herb.*! Fl. May–Aug.

2. **S. maritima,** *Dumort.* Syn. S. indica, *Roxb.*

A much more slender plant than the last scarcely woody below, with more slender leaves ·5–1″ long by ·05″ broad, semiterete, fleshy. Inflorescence leafy to the top. Styles 2.

Salt marshes near the sea. From the Sunderbans southwards, but there is no actual specimen from our area. Fl. May.

7. BASELLA, *L.*

A fleshy twiner with broad entire leaves and small white or coloured 2-sexual flowers in spikes, each with a small green bract and 2 adnate fleshy bracteoles. Perianth fleshy, 5-fid, becoming baccate in fruit, lobes short incurved. Stamens 5 perigynous, anthers versatile. Utricle globose thin, adhering to the seed, included in the fleshy perianth, stigmas 3. Seed erect, subglobose with crustaceous testa and scanty albumen. Embryo plano-spiral with large thin involute cotyledons.

1. **B. rubra,** *L.* Utu ara, *K.*; Pui, *H.*

Stems fleshy usually red. Leaves ovate to orbicular, often cordate or with straight or rounded base, 1·5″ each way or sometimes attaining 5–7″ in length, shining, slightly acuminate. Petiole ·5–1″. Spikes ·5–3″ long with fleshy rhachis. Flowers pinkish or purple, urceolate. Bracteoles coloured like the perianth. Fruit ·25″ diam. ovoid, black, with deep purple juice.

Grown on trellises and hedges throughout Chota Nagpur! Fl., Fr. March–Dec. A pot-herb.

FAM. 110. PHYTOLACCACEÆ.

Shrubs or herbs with alternate entire leaves and small or 0 stipules. Flowers mostly small in racemes, bracteate and 2-bracteolate. Tepals 4–5 imbricate, sepaloid or petaloid, sometimes unequal. Stamens 4, equal in number and alternate with the tepals or twice as many, rarely more, subhypogynous or hypogynous, with usually persistent filaments and deciduous anthers. Carpels 1 or more, free or connate,

superior, 1-ovuled, stigmas usually sessile and recurved. Ovules amphitropous or campylotropous. Ripe carpels baccate or utricular, nutlike or samaroid. Seeds erect, often arillate with fleshy or floury albumen and peripheral embryo usually annular. Cotyledons narrow and flat or broad and unequal with the outer embracing the inner, or foliaceous and convolute.

1. RIVINA, Plum.

Shrubs or undershrubs with entire or faintly crenulate penninerved leaves with minute deciduous stipules, and small 4-merous hermaphrodite flowers in simple terminal racemes finally becoming leaf-opposed or extra axillary. Perianth 4-partite, segments sub-petaloid, equal. Stamens 4 or 8 subhypogynous, 4 exterior alternate with the tepals. Ovary 1-carpellary, unilocular. Style elongate, sublateral or 0. Stigma capitate or penicillate. Fruit baccate, subglobose. Embryo annular. Cotyledons unequal, conduplicate with their edges involute, obscurely 3-nerved.

1. **R. lævis,** *L.* Incl. R. humilis, *L.*

A pretty bushy undershrub with sulcate glabrous or pubescent branches, ovate acuminate entire or subcrenulate glabrous or pubescent leaves 1–4″ long and small rosy-white flowers in racemes longer than the leaves. Tepals obovate or elliptic-obovate, longitudinally venose. Berries bright scarlet, compressed globose. Seed rugosely pitted.

Frequent in gardens and sometimes self-sown! Native of America.

FAM. 111. POLYGONACEÆ.

Herbs, rarely shrubs with alternate, rarely opposite, simple entire or serrulate, very rarely lobed, leaves, often gland-dotted and with stipules usually sheathing the stem (ochreate) and often membranous. Flowers usually 2-sexual, jointed on the pedicel, usually clustered with the clusters often spicate or panicled. Perianth green or coloured of 3–6 free or connate persistent tepals, imbricate in bud. Stamens 5–8, rarely more or fewer, opposite the tepals. Disc, if present, annular or glandular. Ovary free, superior, 2–3-gonous with 1–3 styles, stigmas various. Ovule 1 basal, orthotropous. Fruit a nut, usually enclosed in the perianth which may be accrescent. Seed erect with membranous testa and floury or horny albumen. Embryo various, radicle superior.

A. Herbs or sometimes suffruticose below, ochreæ large:—
  Fls. acyclic. Perianth 3–5-merous. Stamens 1–8 . . 1. *Polygonum.*
  Fls. cyclic, each whorl 3-merous. Stamens 6 . . . 2. *Rumex.*
B. Shrubs, erect or climbing by tendrils. Ochreæ small:—
  Climber with white or pink perianth, dry in fruit . . 3. *Antigonon.*
  Erect with flattened branches. Perianth fleshy in fruit . 4. *Muehlenbeckia.*

1. POLYGONUM, *L.*

Herbs, rarely suffruticose with alternate entire, rarely lobed leaves and tubular membranous stipules. Flowers small or minute, shortly

pedicelled, clustered, the clusters axillary or terminal or in spiciform racemes. Bracts and bracteoles ochreate. Disc glandular or 0. Perianth 4–5-, rarely 3-cleft, tepals acyclic, 2 outer usually smallest. Stamens usually 5–8, perigynous. Ovary compressed or 3-gonous; styles 2–3 or combined below, stigmas usually capitellate. Nut included in the more or less accrescent perianth, 3-gonous or biconvex. Embryo lateral, radicle long, cotyledons flat, accumbent, rarely incumbent.

I. Bracts tubular (sometimes only at base in 13-15):—
  A. Flowers all in axillary clusters . . . . . 1. *plebejum.*
  B. Flowers all in spiciform racemes (subcapitate in 14 and 15):—
    1. Cotyledons incumbent. Stipules mostly with dilated mouth or a distinct limb. Stout herbs:—
      L. softly pubescent or hairy, ovate . . . . 2. *orientale.*
      L. scaberulous, lanceolate . . . . . 3. *limbatum.*
    2. Cotyledons accumbent. Stipules without dilated mouth or limb (exc. in 14). Leaves narrow:—
      a. Hairs, if present, neither retrorse nor prickly. Racemes many-fld.:—
        i. Styles mostly 2. Nut biconvex (rarely few 3-gonous):—
          † Stipules eciliate (at mouth):—
            Whole plant glabrous . . . . . 4. *glabrum.*
            Whole plant white tomentose or cottony . 5. *lanigerum.*
          †† Stipules more or less ciliate:—
            L. elliptic-ovate to lanceolate, ciliolate . . 6. *lapathifolium.*
            L. narrow-lanceolate to linear, glabrous . 7. *minus.*
        ii. Styles mostly 3. Nut 3-gonous (rarely few 2-convex). Stipules ciliate (exc. sometimes in 12):—
          † Racemes dense:—
            ! Branches above, bracts and peduncles glabrous:—
              L. glabrous, or nerves strigillose, usually tapering to a rounded base, stipular setæ not longer than tube . . . 8. *serrulatum.*
              L. shortly appressed-hairy and ciliate, base acute or acuminate. Stipules with long setæ (·3–·5″) usually exceeding the tube 9. *barbatum.*
            !! Branches above and peduncles strigose, bracts more or less hairy:—
              L. as in *barbatum* . . . . . 10. *stagninum.*
          †† Racemes with lower bracts distant, peduncles glabrous:—
            L. strigose beneath. Stipules strigose and ciliate . . . . . 11. *flaccidum.*
            L. glabrous beneath. Stipules glabrous, sometimes eciliate . . . . . 12. *hydropiper.*
      b. Hairs, if present, rigid, retrorse or prickly. Bracts often somewhat expanded above:—
        i. Flowers in very lax few-fld. racemes . . . 13. *prætermissum.*
        ii. Flowers in short oblong or capitate racemes:—
          Stipules oblique at mouth, shortly ciliate. Nut 2-convex . . . . . 14. *pedunculare.*
          Stipules truncate with long cilia. Nut 3-gonous 15. *strigosum.*

II. Bracts flat. Flowers capitate. Leaves broad, often lobed or auricled at base:—
  L. ·5–2″, contracted below into the broadly winged petiole. Stipules obliquely truncate . . . . . 16. *alatum.*
  L. ·5–1·5″. Petiole ·12–·17″, auricled. Stipules short cupular 17. *capitatum.*
  L. 1–6″. Petiole ·3–1″, usually auricled. Stipules long, obliquely truncate . . . . . 18. *chinense.*

1. **P. plebejum,** *Br.* Muniara, *K.*; Muic', *S.*; Raniphul, *Vern.*; Indian Knot Grass.

A diffusely branched prostrate herb, in some forms much resembling the English *P. aviculare*, with usually many stems from the root, varying from 2″ to 18″ in length at the time of flowering. Leaves linear, linear-oblong or in the shorter ones obovate-oblong, ·1–·7″ long, acute or obtuse, often with revolute margins. Stipules short or longer than the leaves, fimbriate with excurrent nerves. Flowers small, green to pink with green midrib, 3–4 or crowded in the axils, under ·1″ long, subsessile, sunk among the stipules or exsert. Nut ·06–·07″ long, somewhat spindle-shaped, but sharply 3-quetrous, brown, shining.

A very common weed on banks, in waste ground, cultivated ground and pastures. In all districts! Fl., Fr. mostly Feb.–May.

Stems and branches grooved, smooth or scaberulous. In var. *Griffithii* very short with very short internodes and appearing almost woolly from the very white-fimbriate stipules. L. sometimes only ·25″ and under. Perianth lobes acute or obtuse.

The plant is eaten as a sag and it is also eaten by horses. The root appears to be always annual or short and woody, whereas that of *P. aviculare* is long fleshy and perennial and becomes a great pest in gardens and fields.

Hooker in the *F.B.I.* enumerates 10 varieties of the plant according to relative length of internode, length and shape of leaves, degree of exsertion of the flower, acuteness of the tepals, etc.

Gage (*loc. cit.*) suggests that vars. *indica* and *brevifolia* form a second species, var. *Griffithii* a third, and var. *polyneura* a fourth species. The following skeleton key based on his work is adapted accordingly:—

A. L. linear or subulate, more than 4 times as long as broad or sometimes dilated upwards from a narrow base (pedicels short in *plebejum* proper) . . . . . α *plebejum* proper and var. β *effusa*.

Probably in all districts.

B. L. not 4 times as long as broad:—

1. Fl. pedicels long, exserted well beyond the stipules . . var. β *effusa*.
2. Fl. sessile or pedicels very little or not exserted:—
   a. Stipules nerveless or 1–2-nerved:—
      Branches not very numerous. L. oblong. Stipules fimbriate, not woolly-looking . . . . . vars. γ *indica* and δ *brevifolia*.

      Chota Nagpur, common!

      Branches very numerous. L. orbicular, apiculate with a distinct median ridge. Stipules very crinite and woolly-looking . . . . . var. ε *Griffithii*.

      Behar, *Kurz.*!
   b. Stipules many-nerved. Nut polished . . . . var. ζ *polyneura*.

2. **P. orientale,** *L.* P. pilosum, *Roxb.*; Bara-pani Mirich, *Beng.*

A tall branching annual 3–10 ft. high with hollow branches; softly pubescent, densely hairy or villous all over. Leaves ovate 3–8″ by 1·5–4·75″ acuminate, lower usually cordate at base, closely nerved, hairy or pubescent both sides, sec. n. 14–18, petiole 1–4″. Stipules short hirsute truncate ciliate with often dilated or recurved mouth without long excurrent bristles. Flowers ·1″ subglobose, white, green or pink in cylindrical racemes 2–5″ long, ·15–·2″ diam. which are laxly panicled. Bracts ·15″ crowded strigosely tomentose and ciliate. Stamens 7–8. Nuts orbicular, ·12″ diam., flattened with rounded margins and rather concave faces, black, shining.

In wet places extending along the foot of the Himalayas. Sikkim Tarai! and probably therefore in N. Champaran and Purneah. Santal Parg., *Maddox*! Fl., Fr. r.s.

The ends of the branches when moistened become thickly glutinous. *Roxb.*

3. P. limbatum, *Meissn.*

Stems stout erect 2–4 ft. strigosely hairy and glabrescent unbranched. Leaves 3–7″ long, lanceolate acuminate, scaberulous or hispid on both surfaces, base tapering, shortly petioled, sec. n. 7–12 fine. Stipules loose, strigose, truncate with a spreading or reflexed scabrid ciliate limb. Flowers white (always ?) in erect stoutly shortly peduncled panicled racemes 2–4″ long, ·25–·3″ diam. Bracts obovate crowded hispid ·15–·2″, 6–8-fld. Stamens 7–8. Nut orbicular, ·12″ diam. flattened with rounded margins and convex faces, black, shining. Cotyledons incumbent.

Ponds and rice-fields. Purneah (probably; it occurs in Maldah close by!). Manbhum, *Milne*, *Clarke*! Fl. Oct.–June.

The very stout stems and expanded or auricular herbaceous mouth of the stipules are very characteristic; the indumentum easily distinguishes it from the last, which also has sometimes a dilated stipular mouth.

4. P. glabrum, *Willd.* Sauri-arac', *S.*

A stout erect herb with the stems up to ·3–·5″ diam. and woody below, strict, rather swollen at the nodes. Leaves lanceolate or linear very tapering, dotted, glabrous, shining, mostly 3–5·5″ long. Petiole short with sheathing base and tubular stipules 1–1·3″ long, neither ciliate nor with excurrent nerves, truncate. Flowers pink in rather dense panicled spiciform racemes 1·5–3″ long, about 5–6 distinctly pedicelled in the axils of the tubular truncate or oblique rounded, glabrous bracts. Nut brown-black orbicular-ovoid compressed biconvex or rarely obtusely 3-cornered, polished. Cotyledons accumbent.

Common on the edges of tanks and water-courses, growing in mud. Purneah! Gya, *Cal. Herb.*! Shahabad (Dumraon), *Cal. Herb.*! Ranchi! Hazaribagh, *Clarke*! Sant. Parg., *Gamble*! Palamau! Manbhum, *Camp.*! Singbhum! Fl. Sept.–Dec. Fr. Nov.–Feb.

Stems usually brown or reddish below. Leaves often attaining 6·5″ by 1″, tapering at the base, quite glabrous, glands usually conspicuous, sometimes obscure; sec. n. about 25 spreading slightly arcuate. Pedicels ·1–·12″ long, conspicuous after the fall of the flowers, with prominent articulation. Perianth tubular-campanulate, ·1″ long, tepals elliptic concave, stamens 6–8 (usually 7) often slightly exsert. Style-arms 2 (presumably 3 in the very rare cases where 3-sided nuts occur).

Eaten as a sag.

5. P. lanigerum, *Br.* Syn. P. lanatum, *Roxb.*

Stems 2–5 ft. procumbent and rooting towards base, much branched, with erect branches clothed with white cottony tomentum. Leaves 3–7″ narrowly lanceolate acuminate, woolly or thickly cottony beneath, tapering into a short petiole or sessile. Stipules short truncate membranous, mouth unequal or lacerate, not ciliate. Fls. small white or red dense in slender panicled racemes, 1–3·5″ long on cottony divaricate slender peduncles. Bracts very small, crowded, glabrous or tomentose, not ciliate. Nut orbicular, much compressed, small, brown or black, shining.

Ditches, etc. In the eastern moister parts of the province. Purneah (Kissenganj), *Kurz*! Santal Parg., *Kurz*! Fl. May–Sept.

Stems sometimes ·5″ diam. below, deep red within (*fide Roxb.*). Leaves usually quite white beneath, rarely glabrous above, sessile or shortly petioled. Stamens 6.

6. P. lapathifolium, *L.* Var. laxum.

Erect, branched, annual, with glabrous stems, subsessile elliptic-ovate to lanceolate or linear leaves, glandular beneath and with ciliolate margins. Stipules sparingly ciliate or eciliate. Racemes cylindric, erect or nodding. Bracts eciliate. Pedicels usually glandular. Perianth greenish, glandular, strongly nerved. Stamens usually 6.

Hooker says "from Bengal to the Sutlej" and (possibly on this account) *Prain* says "Behar." But I can find no specimens from Behar. It is at any rate very rare. *Madden* says "ubique Ganges from Fattehgarh to Calcutta," but then *Madden* mixed this species up with *P. glabrum*, from which it only appears to me to differ in its glandular perianth and subsessile leaves. *Gage* gives no Behar or Orissa locality.

Leaf base contracted, papillose, strigillose or hispidulous on the nerves beneath and margins. Racemes lax, panicled, peduncles papillose, glandular or hispidulous.

7. P. minus, *Huds.*

Stems very slender ascending, glabrous, 6–10″ long, often simple, with linear sessile leaves tapering each end, ·75–1·5″ long, with minute appressed bristles along the margin and usually on the nerves beneath. Stipules sparsely or densely strigosely bristly and bristle-ciliate, cilia shorter than the tube. Flowers very small, white or pinkish turning deeper pink in fruit, in very slender erect racemes ·3–1″ long. Bracts ·06–·1″ glabrous, mouth subtruncate or rounded bristle-ciliate. Style-branches 2, stigmas papillose capitellate. Nut broadly ellipsoid, biconvex, polished brown, ·06″.

Wet ditches, Purneah! Fl., Fr. Nov.–Jan.

Resembling a very delicate form of *P. serrulatum*, from which it is distinguished by the small size of all its parts, the appressed bristles of the stipules (strigosely-hairy in *P. serrulatum*), and especially the 2-fid. style and biconvex nut. Pedicels included in the often coloured bracts. Perianth ·06–·07″ in flower, slightly larger in fruit. Stamens 5 included.

8. P. serrulatum, *Lagasc.*

Stems decumbent below, 10–20″ high, branches glabrous as well as the peduncles. Leaves narrowly linear to linear-oblong, 2–5″ long by ·1–·6″ broad, subsessile, glabrous or slightly strigillose on margins and nerves. Stipules and bracts with bristle-cilia from half as long to as long as the somewhat strigose tube, stipules somewhat strigose. Flowers white in slender erect racemes ·5–1·5″ long. Stamens 5–8. Nut deep purple 3-gonous polished ·07″ long.

Marshes. Ranchi! Palamau! Singbhum! Fl., Fr. Sept.–Jan.

This is like a large *P. minus* with 3-quetrous nuts and is perhaps only artificially separated. Leaves tapering each end or sometimes subcordate at the base. Ovaries sometimes filled with the spores of a parasitic fungus (smut), and the raceme then swollen and much larger than normal.

9. P. barbatum, *L.*

This appears to me to be merely *P. stagninum* without the strigose peduncles and probably *P. stagninum* should be reduced to a variety

of this. *Sir J. D. Hooker* says : " The nearly or quite glabrous stems and peduncles, the long bearded stipules, long weak slender but erect racemes, and shorter weaker cilia of the bracts, best distinguish this from *P. stagninum* ; but none of these characters holds good by itself." The slender racemes are 2–4″ long and leaves 4–7″.

Purneah, *Burkill* ! Ranchi, *Clarke* ! Hazaribagh, *Clarke* ! Manbhum, *Wood* ! Palamau, *Cal. Herb.* ! Banks of Soane, abundant, *J.D.H.* ! Fl. Oct.

L. sessile, linear-lanceolate, tapering both ends, strigose on nerves beneath and on margins, sessile or subsessile. Excurrent setæ of stipules longer than the tube. Racemes panicled, narrow, with glabrous setose-margined bracts.

10. **P. stagninum,** *Ham.*

Erect or ascending 2–3 ft. high with branches above the stipules (by which they are closely sheathed) glabrous or with a few stiff hairs in the lower parts, upper parts and peduncles densely strigose. Leaves lanceolate thinly shortly appressed hairy both sides and ciliate, base tapering into a very strigose petiole ·1–·3″ long. Stipules membranous ·6″ strigose and nerves excurrent into long bristles ·3–·5″ long. Peduncles strigose, short. Racemes ·6–1″ with usually coloured pectinately ciliate bracts, mouth rounded. Perianth campanulate ·1″ long, white. Tepals rounded. Stamens 8 (always ?), disc-glands prominent oblong, connate at base. Styles 3 slender, longer than ovary, connate at base. Nut 3-quetrous with subacute angles, pitchy-black (*F.B.I.*) or brown-black.

Watery places. Purneah ! Fl., Fr. Nov.–Jan.

Var. *a.*

Leaves 3-5·5″ long, linear or linear-lanceolate, very acuminate, sometimes nearly glabrescent, more sparsely and more shortly hairy. Bristles of stipules sometimes as long as tube. Racemes ·7–2″ long. Perianth green, greenish-white or tinged pink. Pedicels ·07″. Nut ·07″, obtusely or sub-acutely 3-gonous, brown-black.

The commoner form. Frequent throughout Chota Nagpur ! Santal Parg, *Kurz* ! Cuttack, *Cal. Herb.* !

This is probably only a variety of *P. barbatum*, differing in the strigose peduncles. The variety also comes very close to *P. serrulatum*, which is yet more glabrous and more slender.

11. **P. flaccidum,** *Meissn.*

Resembling *P. hydropiper* in general appearance, usually larger, 2–3 ft. high with red stems and branches very thinly strigose or glabrous and with gland dots, much swollen at the nodes. Leaves lanceolate, reaching 4·5″ by 1″ usually 2–3″, dotted, somewhat fulvous-strigose beneath and on the midrib above, sometimes also with a few short appressed hairs above. Stipules strigose and bristle-ciliate with the cilia long and often half as long as the tube. Flowers bright pink or white with green base in very lax, very slender, panicled inclined or decurved racemes 3–6″ long. Flowers only 2–3 to a bract, bracts often ·75–1″ apart in the lower parts of the raceme, tubular, obliquely truncate, glabrous, ciliate, cilia mostly long. Nut 3-quetrous, ovoid.

Similar localities to the last. Purneah, *Burkill* ! Ranchi ! Palamau ! Singbhum, common ! Fl., Fr. Sept.–Jan.

Rootstock creeping. Leaves tapering at base and with a short petiole, petiole of lower leaves ·3″, sec. n. numerous, distinct beneath. Fls. ·1″. Perianth glandular,

tepals broadly elliptic or ovate. Peduncles and rhachis glabrous, somewhat angular. Stamens 8. Style deeply 3-fid with capitellate stigmas.

12. P. hyropiper, *L.*

Stems decumbent at base and ascending, more rarely quite erect, 12–20″, glabrous, very slender above, nodes below swollen. Leaves linear-lanceolate, copiously gland-dotted, 1·5–3·25″, glabrous or scabrous on margin, subsessile. Stipules glabrous, with few and usually deciduous bristles mostly under ·1″ long. Flowers pink in rather lax, very slender or filiform racemes which are erect, flexuous, or decurved. Bracts glabrous, gland-dotted or not, truncate with very small, often deciduous cilia, or eciliate. Pedicels mostly exserted to the length of the flower. Perianth glandular. Styles sometimes 2 only. Nut usually trigonous, opaque, granulate, occasional ones flat.

Wet places and streams. Purneah! Damodar River (between Ranchi and Hazaribagh), *Kurz*! Ranchi! Singbhum! Fl., Fr. May–Dec.

13. P. prætermissum, *Hook, f.*

A rather delicate species with creeping stems and erect stems up to 10″ high, glabrous or with reflexed bristles especially near the nodes, oblong or linear-oblong or linear leaves 1·5–4″ long, sagittate or hastate at base with large obtuse lobes or auricles, beneath often purplish and quite glabrous or with a few deciduous reflexed hairs on midrib, margin minutely ciliate. Petiole ·2–·4″ smooth or with bristles. Stipules narrow with thin deciduous hairs, eciliate at apex. Racemes almost capillary, once or twice bifurcate, 2–4″ long, glabrous or somewhat glandular. Flowers very few at the ends of the branches, distant, bracts only 3–5, glabrous except at the shortly ciliate tips, ·1″.

In wet ditches, N. Purneah! Fl. Dec.–Jan. Fr. not seen in our specimens, said to be globosely 3-gonous.

The very slender characteristic forked nearly glabrous axillary racemes with few distant flowers bring this under *P. prætermissum* in spite of the greater hairiness than in the type. The Sikkim specimens in the *Cal. Herb.* have often densely glandular inflorescences.

14. P. pedunculare, *Wall.*

A weak herb with stems decumbent at base, 2–3 ft. high, angled and hispid above with short retrorse bristles or prickles or unarmed. Leaves linear, or somewhat lanceolate-linear, acute or acuminate, 2–4″ long by ·2–·4″ broad, glabrous with hispidulous or scabrid margins, contracted into a very short petiole ·05–·25″ long. Stipules long tubular with dilated very oblique shortly ciliate mouth. Flowers small white in heads or oblong racemes ·15–·4″ long, the heads in 2-chotomous lax panicles with glandular-hispid peduncles and scarious stipuliform bracts at the forks Flowers 1 (or more ?) exserted from the lanceolate acuminate, nerved and pectinately ciliate bracts which are ·15″ long or basal ones up to ·2″ long. Perianth broadly campanulate ·1–·12″ long with rounded tepals. Stamens 5 (–3). Style 2-fid as long as the ovary. Nut thickly biconvex, orbicular or broader than long, ·07–·08″ broad, brown, not polished.

Along river-banks, pats of Chota Nagpur; Neterhat 3000 ft.! Fl., Fr. Sept.–Nov.

As many as six varieties are described in the *F.B.I.* I have only described the form (var. *angustissima*) occurring in our area. The densely and many-fld. heads easily distinguish it from *P. prætermissum*.

15. P. strigosum, *Br.*

Widely creeping (suberect, *F.B.I.*) with angular stems, the angles beset with small reflexed or recurved barbs. Leaves linear-oblong 2–4″ acuminate with rounded or subcordate base, midrib and margins with reflexed small barbs or hispid and upper surface scabrid-hairy. Flowers pink in very short oblong or subglobose heads or racemes ·25–·5″ long, with aculeate or glandular-hispid slender peduncles. Bracts ovate or oblong, ciliate and strigose. Nut globosely 3-gonous.

Creeping over rocks. Neterhat, 3000 ft.! Fl. July–Nov. My specimens not in flower.

Nodes (base of stipules) with a ring of reflexed setæ ·1–·2″ long. Petioles ·2–·5″ long, closely aculeate. Stipules long tubular truncate ·8–1″, with many excurrent nerves terminating in erect setæ. Racemes in 2-chotomous panicles. Tepals obtuse. Stamens 6–8.

Hooker states that all the north Indian specimens are 3-gynous, all the Peninsular digynous; the absence of flowers in our specimens unfortunately precludes our determining to which group they belong.

An allied plant of this group, **P. perfoliatum,** *L.*, found from Kumaon to Central Bengal, but chiefly along the base of the Himalayas, may possibly occur in our area. It is very easily recognised by the long-petioled broadly ovate sagittate leaves with the petioles and angles of the stem with recurved prickles.

16. P. alatum, *Ham.*

A much branched weak rambling herb with slender branches glabrous or sparsely hairy, sometimes glandular-hairy upwards. Leaves ·5–2″ (including the so-called winged petiole, here described as part of the leaf), sessile, elliptic or spathulate-obovate and auricled at the base, membranous, obtuse, sparsely shortly hairy above. Stipules very short obliquely truncate. Flowers ·09″ long in small bracteate heads of which the lower bracts far exceed the flowers, on slender glandular-hairy peduncles. Bracts not tubular, ovate to ovate-lanceolate, glabrous, not ciliate. Nut trigonous or biconvex.

Only recorded from Parasnath, *T. Thomson*, *Kurz*, etc.! Fl. r.s.–Nov.

17. P. capitatum, *Ham.*

Perennial, with many 6–8″ long stems from a short rootstock, ovate or broadly elliptic acute or obtuse leaves ·7–1·3″ long, with the base suddenly contracted to a very short petiole with 2 auricles at its base, margins of leaves and auricles closely ciliate. Stipules ·2–·3″. Heads globose, pink, 1-3 terminal, ·15–·2″ diam. or sometimes ovoid and ·3″ long.

Manbhum, *Campbell (teste Gage)*. It is a hill plant found on rocks and walls, and must have been collected on Parasnath. Fl. May–Aug.

18. P. chinense, *L.*

A diffuse herb scrambling among bushes to a height of 5 ft. or 6 ft. with broad ovate to deltoid or oblong leaves, usually suddenly cuneate on a slender petiole the base of which is more or less expanded, or with a large auricle. Stipules very membranous. Flowers white or pink capitate; heads ·2–·3″ diam. in axillary and terminal divari-

cate pubescent and slightly glandular panicles. Bracts scarious, open and shortly tubular, glabrous, acute. Fruiting perianth often fleshy.

Purneah, in cool damp localities! Parasnath, scrambling among rocks! Meghasani, elev. 4000 ft. in shady places! Fl., Fr. Nov.–Jan.

The plant is very variable and two varieties occur in our area :—

Var. *α* **chinense** proper.

Branchlets glabrous except near the nodes. Leaves deltoidly-oblong, mostly 1–3″, larger 4·7″ by 2·2″, membranous, acute or acuminate, base straight except for a short wedge on the petiole, membranous, pellucid-dotted, midrib beneath hairy. Petiole ·3–·75″ long, basal auricles unequal, often ·4″ broad. Panicles pubescent and glandular.

Purneah!

Var. *β* **ovalifolia,** *Meissn.*

Branchlets glabrous. Leaves large, ovate acuminate, cuneate on one or both sides of the base, 4–6″ by 2–3″, margin sometimes ciliolate, otherwise glabrous. Petiole ·5–1″, auricles small or 0. Stipules over 1″ long, but the upper half or more breaking off, base often glandular. Peduncles glandular-hispid.

This is the mountain form, occurring only at elevations of over 3000 ft. in the Central and Southern Areas.

2. RUMEX, *L.* Dock.

Herbs, usually perennial with stout roots. Radical leaves usually large. Stipules tubular, often disappearing with age. Flowers 1–2-sexual, in panicled or racemed whorls, rarely axillary clusters. Tepals 6 in two series, inner enlarging entire or toothed and often with a tubercle on the midrib in fruit. Stamens 6, anthers basifixed. Ovary 3-gonous, styles 3, stigmas fimbriate. Nut included in the accrescent inner tepals, 3-angled. Embryo lateral, nearly straight; cotyledons linear or oblong.

A. Styles terminal. Flowers 2-sexual. Inner fruiting tepals coriaceous :—
  1. Inner fruiting tepals not broadly alate, not much toothed :—
    L. narrowed into the petiole, lanceolate . . . . . 1. *maritimus.*
    L. contracted above the cordate base, linear-oblong . . 2. *nigricans.*
  2. Inner fruiting tepals broadly alate, wings irregularly toothed 3. *dentatus.*
B. Styles on the angles of the ovary. Flowers polygamous :—
  Inner fruiting sepals membranous, orbicular, reticulate, 2-lobed each end, not tubercled . . . . . 4. *vesicarius.*

1. R. maritimus, *L.* Golden Dock.

A stout erect annual 1–4 ft. high with angled and deeply grooved stems, lanceolate leaves 3–10″ long with the base always narrowed into the slender petiole. Flowers green, yellow-brown in fruit, in few–many-fld. whorls in a leafy panicle. Fruiting tepals, inner ·1″, rhombic- or oblong-ovate erect, with a lanceolate tip and a large oblong tubercle on the midrib, leaving only a narrow margin, teeth when present long needle-like, several times as long as the tubercle with the tip sometimes hooked.

Marshes. Banks of the Ganges, Santal Parg., *Kurz*! Fl., Fr. c.s.–h.s.

This plant occurs in Europe. My English specimens have the racemes very dense with the whorls confluent and the acicular teeth are much more numerous. The panicle as in the Indian one has many very narrow leaves nearly to the top.

Lower leaves often oblong-lanceolate 12″ by 2·5″, waved, petiole 2″, upper gradually smaller, becoming linear.

2. **R. nigricans,** *Hook. f.* Black dock.

An erect less robust annual 6–18″ high with angled and grooved stems, more or less narrowly panduriform leaves 6–8″ by 1–1·5″ with cordate base and leafy or leafless rigid divaricate flowering branches. Fruiting tepals, inner ·16″ lanceolate venose, densely crowded in globose distant or confluent whorls turning black when dry, with very large oblong dark tubercles and lanceolate tips, margins very narrow entire or often with 1–2 short straight teeth or spines. Pedicels short.

Purneah, *Cal. Herb.*! Behar, *J.D.H.*! Fl. r.s.
Lower leaves oblong, 6–8″ by 1–1·5″. Tepals more reticulate than in *maritimus* and teeth less fine; tubercles occupy two-thirds to three-quarters of whole length of tepal.

3. **R. dentatus,** *L.*

A stout erect herb 2–3 ft. high with habit of *nigricans*, angled and ridged stems and oblong obtuse leaves 2–4″ often contracted above the rounded or cordate base, or the upper ones oblanceolate or linear, often waved or crisped and sometimes papillose beneath. Fruiting tepals ·17″–·2″ long triangular, acute or obtuse, with broad closely reticulate wings and strong unequal spreading teeth, tubercle large oblong smooth.

Behar, *Kurz*! Banks of Soane and Ganges, *J.D.H.*! Palamau, *Wood*! Banks of the Mahanadi, Angul! Probably in all districts. Fl., Fr. h.s.
The whorls in my specimens are dense and almost confluent, brown when dry. Panicle not much branched, somewhat leafy. Pedicels about as long as the fruiting tepals with articulation near the base. Reticulation of tepals much raised leaving minute areoles between. Tubercle occupies less than half to two-thirds length of tepals, which have broad uncovered margins. Pedicels much thickened beneath the fruit.

4. **R. vesicarius,** *L.* Palak, Palang-sag, *H.*; Delali, *Vern.* (Purneah); Chuka-palang, *Beng.*; Bladder Dock.

A pale green annual 6–12″ high, dichotomously branched from the root and rather fleshy. Leaves long-petioled elliptic-ovate, broadly ovate or oblong, 1–3″ long, 3–5-nerved from the cuneate, cordate or hastate base. Flowers mostly geminate in short terminal and leaf-opposed racemes only 1–1·5″ long, polygamous (2-sexual according to *Roxburgh*) on slender pedicels. Inner fruiting tepals large, not tubercled orbicular ·4–·5″ diam. very membranous and reticulate, white or pink, 2-lobed each end, without teeth or marginal nerve.

Cultivated. Bettiah, *Hieronymus*! Purneah, *Burkill*! Manbhum, *Camp.*!
Used as a *sag* as well as medicinally. Native of the Punjab hills.

3. ANTIGONON, *Endl.*

Climbers with the branchlets and rhachis of the inflorescence often passing into tendrils. Leaves with amplexicaul petioles and small stipules, often reduced to a stipulary line. Flowers mod.-sized, coloured pink, white or red in small fasicles which, owing to the reduction of the leaves on the flowering shoots to small bracts, appear in more or less zigzag racemes and panicles. Pedicels articulate.

Perianth 5–6-merous, cyclic or acyclic, 3 outer tepals in fruit dry accrescent forming wings. Stamens 7–9 connate at base into a ring with short teeth between the filaments. Ovary 3-gonous with 3 free styles and capitate papillose stigmas. Ovule on a long funicle, at first pendulous, subsequently erect. Nut 3-angular.

1. **A. leptopus,** *Hook. & Arn.* Sandwich Island Creeper.

A beautiful climber, woody below, with ovate cordate or deltoid somewhat rugose leaves and beautiful pink or white flowers in panicled racemes.

Commonly cultivated. Fl. r.s. and c.s. Native of Mexico.

4. MUEHLENBECKIA, *Meissn.*

Shrubs or undershrubs, in our species with compressed soon leafless green branches and small caducous fleshy leaves, nodes with a stipulary line. Flowers polygamous. Perianth deeply 5-fid, more or less fleshy in fruit. Stamens 8–9, reduced to staminodes or 0 in the female. Ovary 3-gonous with 3 often very short styles and broad lobed or fimbriate stigmas.

1. **M. platyclada,** *Meissn.*

An interesting shrub with all the branchlets converted into phylloclades but bearing in the rains small rather fleshy rhomboid leaves. Flowers green and white small in clusters at the nodes. Fruits (including the fleshy perianth) baccate.

Frequently cultivated. Native of the Solomon Islands.

FAM. 112. PODOSTEMONACEÆ.

Aquatics, sometimes moss-like, growing on stones in tropical streams. Stem almost always dorsiventral, branched with leaves or with these confluent into thalloid or frondose laminæ. Leaves when differentiated simple distichous, sessile or stalked, generally with a sheath which may be stipuliform. Flowers mostly terminal, often in a many-fld. scape or dichasial shoot-system, naked or arising from a sheath, mostly 2-sexual, sometimes 1-sexual or dicœcious. Perianth usually reduced to small ovate or linear scales or altogether absent in which case the young flower entirely enclosed in a spathe (spathella). Stamens hypogynous, 1–many, whorled, or sometimes perigynous, free or connate. Anthers with vertical dehiscence. Ovary free, sessile or stalked, 1–3-celled, with a stout central placenta and very thin septa. Styles 2–3 or one and columnar; stigmas 2–3 or one capitate. Ovules many anatropous, axile (only in one genus parietal). Fruit capsular, septicidal or septifragal, valves 2–3. Seeds many minute with mucilaginous testa and no albumen. Embryo straight, radicle inferior.

1. LAWIA, *Tulasne.*

(Terniola, *Tul.*).

Stems confluent into a lobed thallus appressed to the substratum (filiform and floating in one species not in our area), leaves minute linear or setaceous. Base of peduncle often surrounded by a raised ring or cylinder closely covered with leaves; flower without a spathella. Flowers 2-sexual with hyaline 3-merous perianth, 3 free stamens and 3-celled ovary with very delicate partitions and 3 spreading linear or subulate styles. Placentæ thick forming an axile column with very numerous ovules. Capsule septicidally 3-valved, the septa evanescent.

1. **L. zeylanica,** *Tul.* Syn. Terniola zeylanica, *Tul.*

A minute lichen-like or moss-like plant with branched thalloid stems closely adpressed to the rocks on which it grows and bearing tufts of papillæ-like or linear leaves on its surface and aggregated round the short cup-shaped flowering branches. Pedicels ·3·–4″ erect bearing a ·08–·01″ long flower. Tepals 3 oblong rounded ·06–·07″. Anthers exserted, filaments very slender, flattened. Stigmas subulate. Capsule oblong-ellipsoid, ·08″ long, slightly 3-grooved, not at all ribbed nor angled until dry, when it appears 3-ribbed.

Forming patches on wet rocks in the rivers of Angul where these flow through shady forest! Fl., Fr. Jan.–Feb.

Branches of thallus not more than ·15″ broad. Leaves ·02–·12″.

*Willis** reduces all the first six species in the *F.B.I.* to *Lawia zeylanica*; all have leaves over ·1″ and the shorter-leaved varieties have ribbed capsules. In *Journal of As. Soc. Bengal*, xv, 1919, No. 7, I stated that our plant had not ribbed capsules, but I find that *on drying* these become ribbed! No *Lawia* has previously been discovered this side of the peninsula.

FAM. 113. ARISTOLOCHIACEÆ.

Herbs or shrubs, often climbing. Leaves alternate simple entire or lobed, often palminerved, exstipulate.† Flowers often large solitary racemose or cymose, 2-sexual, bracteate or not. Perianth corolline superior, regular or often very zygomorphic, variously shaped, gamophyllous with valvate lobes. Stamens 6 or more, subsessile in a ring round the base of the style with which they are often combined into a column or gynostemium, if free filaments short and thick, anthers with longitudinal dehiscence. Ovary inferior, rarely almost superior, 4–6- but rarely 5-celled, stigma rayed. Ovules many, anatropous on parietal placentæ which are free or meet in the axis or placentæ axile. Fruit capsular or coriaceous and bursting irregularly. Seeds many with copious albumen and small or minute embryo.

* *Annals of the Royal Botanic Gardens, Peradeniya*, vol. i, pt. 4, Sept., 1902.

† The intrapetiolar stipule-like appendages of many species of *Aristolochia* are strongly developed bracts of suppressed or finally developed axillary shoots.

1. ARISTOLOCHIA, *L.*

Leaves entire or lobed, often with a stipule-like bract in their axils. Perianth-tube inflated at the base, then contracted and above with a dilated oblique 1–2-lipped limb (very large in some garden species). Anthers 6, rarely 5 or more than 6, column very short, 3–6-lobed above. Capsule septicidally 6-valved or splitting through the placentas, thin-walled and the dehiscence frequently carried down into the pedicels which become 6-partite. Seeds flat (in our species) often with the remains of the placenta attached.

Flowers solitary. Bracts large orbicular :—
Stems prostrate. Leaves glaucous beneath . . . . . 1. *bracteata.*
Flowers mostly in 1-many-fld. racemes or clusters. Bracts small :—
L. linear to panduriform, not deeply cordate, 2–4″ long . . . 2. *indica.*
L. lanceolate to lanc.-ovate, deeply cordate, 3–10″ long . . . 3. *tagala.*

1. A. bracteata, *Retz.*

Stems slender, prostrate, 12–18″ long with reniform or broadly ovate leaves 1·5–3·5″ both ways, cordate at base with a broad shallow sinus, glaucous beneath, finely reticulate. Flowers 1·3–1·75″ long (excluding the ·2″ ovary), solitary, with a large orbicular bract at the base of the peduncle. Perianth subglobose at the base, then cylindric with a trumpet-shaped mouth and dark-purple linear lip as long as the tube. Capsule ·6–·75″, oblong-ellipsoid, 12–ribbed. Seeds deltoid slightly cordate at base, ·25″.

West Behar, *Bengal Plants*. But there are no specimens either at Kew or Sibpur, and it is possibly recorded on the basis of its general distribution : Bundelkhand, etc. Fl. Aug.–Nov.

2. A. indica, *L.* Bal-bolena, Oyidi, *Or.* ; Isharmal, *H.* ; Isror (Gaya); Gad, *S.*

A glabrous herbaceous or shrubby perennial with a woody root-stock, slender sulcate branches and usually panduriform leaves 2–4″ by 1–2″ with acuminate apex and 3–5-nerved base. Flowers ·7–1·5″ long, 2–7 in a very short raceme or sub-clustered, with lanceolate acuminate bracts ·07″ long. Perianth globose at the base ·25″ diam. and slightly 6-grooved, then narrowly tubular for ·5–·6″ and bent nearly at right angles to previous axis, with a purple dilated or obliquely trumpet-shaped mouth ·3″ diam. notched in front and produced obliquely behind into an oblong strap-shaped brown-purple appendage or lip ·5–·7″ long with revolute margins. Capsule subglobose or broadly oblong and narrowed into pedicel, 1–1·8″ diam. at broadest part, dehiscing from the base, after dehiscence parachute-like, the dehiscence being continued into the clavate pedicel which divides into 6 strands continuous with the midribs of the valves which remain united above. Seeds deltoid or triangular, flat, winged, ·03″, wings membranous.

In open jungles. Gaya Hills ! Manbhum, *Kurz* (near Raneeganj) ! Santal Parg., *Haslett* ! Puri, frequent on the sandstones ! Angul ! Mayurbhanj ! Fl. June-Oct. Fr. Nov.–March, but the parachute-like old capsules may be found up to the end of the hot season. Deciduous and sometimes dying back to the root.

Leaves sometimes vary from linear to obovate, but in our specimens they are always sub-panduriform (constricted above a broad base) and broadest above the middle. Petiole slender ·25–·5″. Pedicels ·2–·3″ thickened upwards. Hypanthium

·2-·25″, 6-ridged, with a solid beak ·1-·15″ long. Limb of perianth somewhat villous with a recurved villous margin and lip with revolute margins, throat and lip puberulous below, glabrous above the middle. Stigmas 6 fleshy, sessile on the top of the column in a ring round a depressed centre.

Roxburgh says that the root is nauseously bitter. A decoction is used for fever in Gaya. The plant is supposed to ward off snakes by the Oriyas and to be a cure for snake-bite by the Santals. This is probably from the fancied resemblance of the flower to the head of a serpent and is interesting, inasmuch as several species have enjoyed a similar reputation in both North and South America (f. *Solereder*).

3. A. tagala, *Cham.* Syn. A. Roxburghiana, *Klotzsch.*

A more robust twiner than the last, with large lanceolate or ovate-lanceolate leaves 3–10″ long (on same plant) finely acuminate at apex and with deeply cordate 5-nerved base. Flowers very similar to those of the last species 1–2″ long, in 1–2-nate short several-fld. racemes with ovate-acuminate small bracts. The tubular portion of the perianth is usually oblique to the globose base and curved, but not at right angles to it, lip deep purple (sometimes described as pale green). Fruit as in the last but larger. Seed flat triangular with rounded corners, wings thick and pithy, nucleus verrucose on one face ; but *Hooker* states that they are very variable.

Frequent in open jungles in the Sikkim Tarai and Duars, and probably occurring therefore in Purneah. Fl. April–May. Fr. May (of succeeding year ?)

The embryo is only ·02″ long and the very minute linear cotyledons much shorter than the tigellus.

FAM. 114. PIPERACEÆ.

Herbs or shrubs, often climbing, aromatic with minute glands (secretory cells) which very commonly give rise to transparent dots in the leaves. Leaves alternate opposite or whorled, entire, stipules 0 or connate and intrapetiolar or adnate to the petiole. Flowers minute, 1–2-sexual, in axillary or terminal spikes and subtended by peltate bracts. Perianth 0. Stamens 2–6, rarely 1 or 7–8, hypogynous, anthers often jointed on the filaments, dehiscing longitudinally or cells confluent. Ovary 3–4-carpellary, 1-celled, or of 3 or more carpels free or connate below ; stigmas sessile, simple or penicillate. Ovules 1 or more, orthotropous. Fruit in the case of syncarpous ovaries baccate or indehiscent, of apocarpous ovaries coccous or follicular. Seeds globose, ovoid or oblong ; testa thin. Embryo minute, enclosed in a sac of endosperm at one end of the copious floury perisperm ; cotyledons minute or obsolete, radicle superior.

Shrubby or herbaceous. Fls. dicœcious or rarely 2-sexual. Anther-cells distinct (or confluent on dihescence). Stigmas 3-5 more or less connate or confluent . . . . . 1. *Piper.*

Succulent herbs. Fls. 2-sexual. Anther-cells confluent. Stigma penicillate . . . . . 2. *Peperomia.*

1. PIPER, *L.* Pepper.

Shrubs, rarely herbs, often climbing, with swollen nodes, usually glandular and aromatic. Leaves entire, mostly unequal-sided,

stipulate. Flowers very minute diœcious, very rarely 2-sexual, spiked, each in the axil of a peltate bract or bract adnate to and sometimes decurrent on the rhachis, lateral bracteoles sometimes present and forming low ridges on each side of the flower or connate in a semilunar form. Stamens 1–4, rarely more, filaments short, anthers 2-celled, cells often confluent by dehiscence. Ovary 1-celled, style conic beaked or 0, stigmas 2–6. Ovule 1 erect. Fruit baccate. Seed usually globose, testa thin, albumen hard.

A. Bracts orbicular or obovate, peltate with margins free. Fruiting spikes dense, not interrupted:—
  1. Stems slender, creeping or rambling, never climbing:—
    L. cordate, lower long-petioled, upper often amplexicaul. Stamens 2–3. Fem. spikes ·5–1·2″ . . . . . 1. *longum.*
  2. Stems climbing by adventitious roots, often stout:—
    a. Bracts shortly stipitate:—
      L. not cordate, with 3 primary nerves converging to apex 2. *peepuloides.*
    b. Bracts sessile:—
      Midrib with 3–5 rather weak sec. n. not converging to apex. Fruiting spikes under 1·5″ conical . . . 3. *chaba.*
      Midrib with one sec. n. each side converging to apex. Fruiting spikes red very fleshy cylindric 1–5″ . . . 4. *betle.*

B. Bracts adnate to the rhachis at base and sides. M. and F. spikes very slender in flower. Fruiting spikes interrupted:—
  L. coriaceous, often glaucous beneath, glabrous or indumentum beneath microscopic. Ovary immersed in rhachis . . . 5. *nigrum.*
  L. membranous, thinly shortly hairy beneath. Ovary sessile with broad base on the pubescent rhachis . . . . . 6 *attenuatum.*

1. **P. longum,** *L.* Pipal (the plant), pipramul (the roots), *Th.*; Pipal, *H.*; Pipra-mohr, *Kharw.*; Narjom-red, Ralli-red, *K.*; Ralli, ranu-ran, *S.*; Long Pepper.

A creeping and rambling aromatic herb with distant alternate lower long-petioled deeply cordate, usually ovate or orbicular, upper more oblong and sessile or amplexicaul leaves. Diœcious. Bracts of both sexes stalked peltate with free margins all round. Bracts ·05″ diam. Bracteoles 0. Male spikes slender, yellow, 1·5–3·5″ long. Stamens 2–3. Fem. spikes ·5–·75″ in flower, up to 1·2″ long in fruit, bracts similar to male, but more distant and less stipitate; ovary sunk in and more or less confluent with the thick rhachis, stigmas 3–4 lanceolate spreading papillose. Berries distinct ·1″ diam.

In damp ground under shade. Champaran to Purneah, frequent! Santal Par., not common! Singbhum, under dense shade! Palamau! Manbhum, *Camp.*! Mayurbhanj, in the mountains! Mals of Puri! Angul! Fl. July–Aug. Fr. Dec.–Jan.

Stems sulcate when dry, usually distinctly puberulous and shoots sometimes pubescent. Normally the leaves are broadly ovate or the lower ones even broader than long and occasionally reniform, but in the Puri specimens most of the leaves are elliptic-oblong 3–5″ long, tapering or shortly suddenly acuminate, sometimes all petioled, very closely and minutely dotted rather pale beneath, basal auricles rounded with broad or narrow sinus, principal nerves 3, reaching or nearly reaching and meeting at apex, one (each side) reaching about half way and soon looped and often one shorter additional one near base, nerves and petiole often puberulous, lower petioles 2-3″ or often exceeding blade, sometimes all leaves petioled.

Both root and fruit are stimulant and carminative and used for cough. The root is also used in Chota Nagpur for fermenting rice-beer. It is also said to be a valuable alterative tonic and is sometimes used as a spice.

2. P. peepuloides, *Roxb.*

A slender climbing shrub adhering to the trunks of trees by its adventitious roots, with firm pale-coloured, often pustulate, branches. Leaves thin oblong, ovate-lanceolate or oblong-lanceolate, long-acuminate, 4–5·5″ long, base not cordate but very oblique and rounded, both sides glabrous, under surface with microscopic white dots; primary nerves, 3 more or less meeting in apex as in *P. longum*, 1 each side reaching about half-way and often 1–2 very weak ones added; transverse tertiaries weak. Petiole ·2–·4″. Male spikes slender leaf-opposed ·75–2″ on peduncles ·1–·15″ with close peltate shortly stoutly pedicelled bracts ·025″ diam., stamens 2–4 to each bract. Fem. spikes very short ·2–·7″ on peduncles ·1–·2″, cylindric in fruit with very close berries ·08″ diam. and remains of the peltate bracts between.

Extreme north of the province. Hills of N. Champaran in damp situations! Fl. Oct.–Dec. Fr. Feb. March.

Some specimens named *P. peepuloides* at Kew, collected in the Darjeeling District and Khasia Hills, have flexuous fruiting spikes 1-1·5″ long, peduncles ·3–·7″ long and berries ·14″ diam. They seem doubtfully the same species.

3. P. chaba, *Hunter.* Syn. P. officinarum, *Cas. D.C.*; Chavica officinarum, *Miq.*; Chai, *Beng.*; Chab, Chair, *H.*

Stout, shrubby, climbing by means of its adventitious roots, quite glabrous. Leaves sub-coriaceous oblong or lanceolate-oblong or lower ovate-lanceolate, acute or acuminate, with obliquely cordate or sometimes subequal or attenuate base, pale beneath. Petiole ·25–·5″. Spikes leaf-opposed erect, fleshy, with the peltate bracts sessile. Male spike "about equalling the leaf," stamens 2–3.* Female spike much shorter, ovary immersed in the rhachis, stigmas 3. Fruiting spikes "1–2″ long, ·5″ diam.," broadest at base, obtuse, forming a fleshy cone of innumerable berries each about ·08–·12″ diam.

Only cultivated in India. I have seen no authentic specimens from our area. Fl. July. Fr. Sept.

Stems finely grooved and about 20-ridged, glabrous. Leaf base not cordate (though it is cordate in very young plants), mostly unequal, each side rounded or obtuse or one side subcordate or acute, 2–5″, usually no strong basal lateral nerves (an occasional leaf may show one and *Hooker* says base 3–5-nerved!), sec. n. 4–5 mostly alternate, but sometimes one pair opposite, not very strong, not distinctly looping. Male spikes (from *Miquel's* figure) about 1″ cylindric on peduncles ·5–·6″. Fem. spikes somewhat conical, compact, ·4″ in flower, ·8–1·2″ in fruit on peduncles ·3″ long.

4. P. bétle, *L.* Pan, *H. Beng.*; Betle-leaf Pepper.

A climbing shrub with woody roots, glabrous or buds pubescent. Leaves coriaceous from broadly cordate-ovate to obliquely elliptic oblong, 4–7″ long by 2–4″ broad, acuminate, primary or sub-primary nerves 5–9, usually 7, midrib with 1 sec. nerve both sides. Petiole ·3–1·5″. Spikes pendulous, bracts orbicular or somewhat obovate, sessile on the hirtellous rhachis. Male spikes 3–6″ by ·1–·12″ diam., stamens 2. Female long-peduncled, ·7–3·5″, ovary immersed in and confluent with the rhachis, apex tomentose, stigmas 4–6 lanceolate. Fruiting spikes stout 1–5″, berries ·17–·25″ diam. very numerous,

* None of the specimens I have seen show male inflorescence.

dense fleshy and often confluent into a cylindric fleshy red mass. Peduncle 1–1·5″.

Cultivated (in *pan-baris*) in most districts, but especially Purneah and Orissa.

Lowest strong pair of primary nerves (there is usually a weak pair below these) extending two-thirds to three-fourths length of leaf, a strong pair of sub-primary or secondaries reaches to or nearly to the apex, tertiaries numerous scalariform or sometimes more reticulate, base of leaf rarely subcordate, usually oblique and rounded or the lower side only rounded, the other obtuse or subacute.

The leaves form the well-known masticatory with the addition of lime, catechu and betle-palm nuts. To these are often added other aromatic flavouring ingredients. Betle-leaf thus chewed acts as a gentle stimulant and exhilarant. The leaves are also used as a domestic remedy in various ways (*Dutt, Mat. Medica*, p. 245).

De Candolle (*Prod.*, xvi, p. 359) describes a variety "*siriboa*" with the young leaves and petioles pubescent.

5. **P. nigrum,** *L.* Syn. P. trioicum, *Roxb.*: Kali-mirich, Gol-mirich, *H., Beng.*; Chai, Cherwud, *Or.* (the wild plant); Pepper.

A rather stout climber up to 20 ft. high, ridged on the branches. Leaves 5–6″ by 2–4″ from broadly lanceolate to broadly ovate, on the same plant, acuminate, shining dark green above, often (always ?) glaucous or white beneath, lower roundish and nearly equal-sided and slightly cordate; principal lateral nerves 3–4 at or close above the base, lowest weaker short or soon looped or absent, next arcuate for half length of leaf then continued in loops to its apex; above these a strong lateral nerve from far below the middle arcuate to the apex; tertiaries sub-scalariform, not much raised beneath in the cultivated plant; base rounded or oblique with one side acute. Spikes very long slender pendulous, sometimes the female bearing some 2-sexual flowers, fls. mostly dicœcious. Bracts adnate to the rhachis at base and sides, sub-oblong but widened upwards, truncate rounded or retuse at apex and with the adnate bracteoles in the female forming a minute cup round the ovary. Male spikes filiform up to 7″ long pendulous, bracts each with 3 subsessile anthers. Fem. spike shorter, thicker with ovary immersed in the rhachis, stigmas 3–4 subulate. Herm. fls. have 2 short stamens closely adpressed to the pistil or pistillode. Berry red, sessile globose in interrupted fleshy spikes.

But little cultivated and in the damper hotter parts only, but the following form is wild. Fl. May (and at other times?).

Var. **trioicum,** *C.D.C.* Syn. P. trioicum, *Roxb.*

Stems up to 2″ diam., branches firm but with a large pith, mostly pustulate below, leaf-buds minutely pubescent. Leaves 4–6·5″, obliquely ovate, long-acuminate, rather coriaceous and somewhat bullate with depressed nerves above, pale or glaucous and microscopically puberulous beneath, base obliquely shallowly cordate, midrib very strong tapering upwards, with a strong lateral nerve each side from a little above the base (sub-primary), a weak one each side below the subprimary, and a strong sec. n. each side sometimes subopposite, sometimes alternate, intermediate and tertiary venation subparallel, looping and reticulate. Petiole ·4–·6″. Stipular scar prominent.

Wild in the mountains of Mayurbhanj, near streams above 3000 ft.! Fl. Sept.–Oct. (mine were not in flower).

I have little doubt that this is *Roxburgh's* plant which was collected in the same range of mountains further south. *Roxburgh** says "in *trioicum* the leaves have a glaucous appearance, which readily distinguishes it from *nigrum*, which has shining dark green leaves," but *Miquel* says "*trioicum* has leaves less white beneath, also that the leaves are narrower, tending more to the lanceolate form, and are less coriaceous and the amenta trioœcious."

The cultivated *P. nigrum* is the source of black and white pepper. The berries plucked just before they turn red and dried constitute black pepper. The ripe fruit deprived of the pericarp by maceration in water, then dried in the sun, becomes white pepper. Pepper is used by the Hindus in dyspepsia and very largely in cholera epidemics.

6. **P. attenuatum,** *Ham.*

Rambling and climbing on trees by its adventitious roots, with soft slender glabrous branches grooved when dry and broadly ovate membranous leaves 4–5·5″ with subregular or slightly oblique rounded retuse or cordate base and abruptly acuminate apex, upper surface glabrous, lower thinly shortly hairy especially on the nerves. Primary (and sub-primary) nerves 7, the midrib and 2 subprimary (a little above the base) reaching the apex but the latter sometimes looped before doing so, outermost nerves shorter and weak, one reaching about half way to apex and looping, tertiaries very slender subparallel. Petiole ·7–2″. Spikes solitary leaf-opposed very slender, about ·05–·08″ diam. Males 3–5″, bracts adnate cupular, rounded at apex, bracteoles slender, stamens 2–4 exserted. Fem. 2·5–3·5″ on slender peduncles ·5″ long, bracts rather distant rounded truncate with margins decurrent below and with the bracteoles forming a low membranous rim. Ovary sessile glabrous with a broad base and 3–4 short spreading stigmas. Fruiting spikes elongating to 6–9″, berries ·15″ diam. globose, rhachis pubescent.

Mals of Orissa. Fl. Aug.-Sept. New shoots from April onwards through the r.s.

2. PEPEROMIA, *Ruiz & Pav.*

Herbs, usually succulent with alternate opposite or whorled entire gland-dotted exstipulate leaves. Flowers 2-sexual, minute bracteate, sessile, or sunk in the rhachis of solitary or fascicled spikes. Stamens 2 very short, anther-cells confluent. Ovary 1-celled, stigma lateral or terminal usually penicillate. Ovule 1 erect. Fruit minute, indehiscent. Seed with membranous testa.

Leaves whorled ·25–·4″, elliptic to orbicular or obovate . . . 1. *reflexa.*
Leaves opposite and alternate ·5–1″, ovate . . . . . 2. *pellucida.*

1. **P. reflexa,** *A. Dietr.*

A small tufted herb growing on tree trunks, 4–6″ high, much branched with firm ridged and grooved branches and elliptic orbicular or somewhat obovate leaves ·25–·4″ long mostly 4 in a whorl, thick and rather fleshy when fresh, coriaceous when dry, margins recurved. Spikes mostly terminal ·5–1·25″ long on slender peduncles ·3–·5″ long, rhachis pubescent. Bracts peltate, distant, very minute, under ·02″ diam., the flowers sunk in cavities of the rhachis above them.

Parasnath, *Wood, C. B. Clarke*! Meghasani, 4000 ft.! Fl. April–May.

Stem described as pubescent in *F.B.I.* In my specimens the whole plant is

* He also describes the bracts as peltate, but does not figure them so. *Wight's* figure is said to be after *Roxburgh*.

glabrous except the rhachis of the spike which is distinctly pubescent and sometimes the young branches and petioles which are puberulous. Petioles ·05–·15″ long.

2. **P. pellucida,** *Kunth.*

A very succulent herb becoming membranous when dry 3–10″ high with broadly ovate acute 7-nerved leaves ·5–1″ long and very slender leaf-opposed spikes 1–2″ long by ·03″ diam., glabrous. Peduncle hardly any. Flowers distant sunk in the rhachis, with most minute peltate bracts ·007″ diam. Fruits ·02″ diam. globose prettily marked with about 10 vertical ridges and minute transverse very fine raised lines between.

Frequent in plant houses, etc., as a weed, but principally noticed by me in the Terai and Duars outside our area. Fl., Fr. c.s.
Native of South America; now more or less naturalised.

FAM. 115. LAURACEÆ.

Trees, more rarely shrubs, or (*Cassytha*) a parasitic filamentous climber. Leaves alternate, rarely opposite or subverticillate, or (*tCassytha*) 0, entire, frequently clustered at the ends of the branchlets, usually with a characteristic aromatic smell when bruised due to minute glands sometimes visible as translucent dots, exstipulate. Flowers small, greenish or yellowish, regular 1–2-sexual, often clustered or cymose, mostly 3-merous. Tepals usually in 2 series of 3 each, subsimilar, often connate below, more rarely tepals 5 or rudimentary or 0. Stamens in 2–4 3-merous whorls of which one whorl is often reduced to staminodes, hypogynous or perigynous, inner often with 2 large glands at the base; anthers 2- or 4-celled dehiscent introrsely or extrorsely by as many valves, lids finally deciduous. Ovary 3-carpellary, 1-celled with one pendulous anatropous ovule, style terminal, stigma simple, discoid or dilated often 3-lobed. Ovule 1 pendulous anatropous. Fruit baccate, drupaceous or nearly dry, rarely enclosed in or adnate to the perianth tube, but often surrounded at the base by the thickened accrescent receptacle or by the base of the tube and supported on a thickened pedicel. Seed with membranous testa, exalbuminous. Embryo with large plano-convex cotyledons, radicle superior minute.

The Laurels (though this is not well exemplified in our species) have usually a very characteristic method of branching; only one or two of the axillary buds from the crowded terminal leaves develops into a slender green shoot bare of leaves at the base.

I. Not twining nor parasitic :—
  A. Inflorescence dense, clustered or umbelliform. All anthers introrse and 4-celled :—
    Flower-buds in densely imbricating bracts. Leaves sub-whorled . . . . . 1. *Actinodaphne.*
    Flowers in involucrate umbels. Leaves scattered . . 2. *Litsæa.*
  B. Inflorescence laxly cymose or panicled. Innermost whorl of perfect stamens with extrorse anthers :—
    1. Anthers 4-celled. Perfect stamens 9 :—
      a. Tepals persistent. Leaves penninerved :—
        Fruiting tepals spreading or reflexed, not hardened 3. *Machilus.*
        Fruiting tepals erect, hardened . . . . . 4. *Phœbe.*
      b. Tepals deciduous, leaves often 3-nerved . . . 5. *Cinnamomum.*

2. Anthers 2-celled :—
Fruit not enclosed by perianth-tube . . . . . 6. *Beilschmiedia.*
Fruit enclosed by and often adnate to perianth-tube . 7. *Cryptocarya.*
II. Twining leafless thread-like parasites . . . . . 8. *Cassytha.*

1. ACTINODAPHNE, *Nees.*

Evergreen trees with subverticillate leaves and small dicœcious fls. in axillary or lateral dense bracteate clusters, racemes or umbels, the bracts imbricating and caducous. Calyx-tube short. Tepals 6, deciduous in fruit. St. 6–9. Anths. all introrse and 4-celled. Staminodes 9 in female. Fruit seated on the enlarged cup-shaped perianth tube.

1. **A. angustifolia,** *Nees.* Inc. A. Hookeri, *Meissn*; Jharjhampa, Tengeda, Sabalia, *Or.*

A mod.-sized tree with subverticillate (mostly 6 in a whorl) lanceolate to narrowly oblanceolate leaves, rarely in our area lanceolate-obovate, 4″ by 1″ to 10″ by 2·5″, glaucous beneath and dark shining above, tapering both ends. Petiole ·3–·5″. Fls. mostly from the axils of fallen bud scales between the verticils, inflorescence silkily tomentose. Males clustered or shortly racemose with rhachis not exceeding ·3″ and silky pedicels ·2–·25″, perianth rotate or subcampanulate, tepals ovate to ovate-oblong, ·15–·2″, nearly glabrous inside, st. far exserted with anthers ·1″ long, filaments ·15″ pilose. Fem. in clusters or in subsessile simple or slightly branched umbels, tube campanulate ·08″, tepals spreading ovate-oblong ·12″ long, staminodes 9 perigynous linear-subulate, innermost 2-glandular as in the male, ovary and style hirsute. Fruit globose or elliptic ·25–·3″ seated on the cupular truncate swollen perianth-tube.

Valleys in good soil, over the whole province in the better forests, but nowhere abundant. Fl. Aug. (or Feb. in the south). Fr. Nov.–May. Evergreen.

Shoots and innovations densely brown villose, buds perulate. Old leaves somewhat brown-villose on the nerves beneath or quite glabrous, sec. n. 7–12 oblique, raised beneath, weak and looping towards margin, tertiaries very fine, scalariform, margin thickened. Petiole tomentosely-hairy or finely pubescent or glabrescent according to age.

Excepting possibly some specimens with broadly ovate-lanceolate leaves not occurring in our area the northern *A. angustifolia* and the southern *A. Hookeri* are the same species. *Mr. Gamble* has kindly supplied me with excellent M. and F. flowering specimens of *A. Hookeri* collected by *C. E. C. Fischer* in Chingleput, and these more closely resemble specimens from northern Bengal than they do some from intermediate localities such as southern Orissa. The two species are widely separated by *Meissner* in the *Prodromus* since he places (as *Hooker* says *wrongly*) *A. Hookeri* in the section Notholitsæa. Possibly *Meissner's A. Hookeri*, which he divides into 3 varieties, really includes 3 different species, one of which only belongs to *angustifolia*. *Hooker* also places the two species far apart on the characters "fem. fl. in sessile or subsessile clusters or umbels" in one section to which he assigns *A. Hookeri*, and "fem. fl. in peduncled umbels or clusters" in the other section to which he assigns *A. angustifolia*. As, however, he says under *A. Hookeri*, "fem. umbelled or subracemose on a short stout peduncle," these sectional characters become immediately vitiated, and the only difference I find is that *angustifolia* has the umbels often compound. The geographical test, Northern India or Deccan species, is also inapplicable from my having collected the plant from Chota Nagpur, Bonai, Puri (with oblanceolate leaves only 5·2 by 1·9″ only), Mayurbhanj, and Pallahara State (*Cooper*!), which connects up the two areas of distribution. The shape of the fruit is given as globose in the *F.B.I.* in the case of *A. angustifolia* and ellipsoid in the case of *A. Hookeri*, but this is not consistent with the other distinctions.

The heartwood is brown but is not used.

2. LITSÆA, *Lamk.*

Trees, more rarely shrubs, with leaves nearly always scattered and alternate. Flowers several in an umbel surrounded by an involucral whorl of 4–6 concave sepal-like bracts, umbels pedicelled, usually again umbelled or racemed or fascicled, axillary or from leaf- or bract-scars. Perianth-lobes usually 6, but sometimes very incomplete or absent, tube or hypanthium sometimes greatly enlarged in fruit. Stamens 6–20, filaments of the one or two innermost whorls (if present) 2-glandular.

A. Perianth very incomplete or 0, not (or slightly) enlarged nor cupular in fruit:—
Pedicels clavately thickened in fruit. St. 9–20 . . . . . 1. *sebifera.*
B. Perianth with 4–5 subequal tepals:—
1. Perianth tube only slightly enlarged and somewhat cupular in fruit. Tepals 5-6:—
L. elliptic to oblanceolate-oblong, strongly nerved beneath with raised tertiaries pubescent . . . . . 2. *polyantha.*
L. lanceolate acuminate with slender nervation . . . . 3. *salicifolia.*
2. Perianth much enlarged and cupular in fruit. Tepals 4:—
L. large shining oblong to lanceolate, nervation obscure irregular . . . . . 4. *nitida.*

1. L. sebifera, *Pers.* Chiur, *Kharw.*; Medh, Menda, *H.*; Porjo, *M.*; Baghoari, Jaisanda, Besond, *Or.*; Baghtal, *Or.* (f. Cooper); Paruhi, *Bhuia.*

Usually a small, sometimes a m.s. tree, aromatic, with leaves very variable in size and shape, but normally ell.-lanceolate and acuminate, pubescent or tomentose on the ovoid leaf-buds and shoots, but glabrescent; sec. n. 6–12 fine oblique reaching nearly to margin, tertiaries very fine and minutely reticulate between. Petiole slender ·7–1″. Flowers yellowish (from the yellow anthers) with very short pedicels forming capitate umbels supported by 4–6 concave orbicular bracts on slender peduncles ·3–·8″ long which are either racemed, umbellate or corymbose on a common peduncle of variable length which is axillary or from the axils of caducous bracts on the new shoots below the leaves. Inflorescence often appearing nearly simple in fruit from only one ovary developing and pedicels greatly clavately thickened. Hypanthium minute in flower, thickened and disc-like in continuation of the pedicel and ·15–·19″ diam. in fruit, tepals 0 or imperfect. St. 9–20 with long villous filaments. Glands fleshy on villous stipes. Fruit globose black ·35–·47″ diam.

Very widely distributed over the whole province, in valleys and cool aspect of hills. Champaran, up to 4 ft. girth! Gaya! Chota Nagpur, all districts! Sambalpur! Bonai, "a large tree," *Cooper*! Mayurbhanj! Angul! Puri (Mahanadi delta, near the sea)!

Fl. June–July. Fr. Sept.–Nov. Evergreen, new shoots in May.

Bark grey, smooth. In big trees becoming dark grey and slightly rough. Blaze soft yellow-brown and dirty white, with a little chlorophyll in outer layer.

The bark has repute for medicine in several districts. In Sambalpur it is used as a poultice in aching pains of the body. *Mr. Cooper* states that it is used medicinally by the Bhuias and is much valued. The wood is generally said to be durable and not attacked by insects. *Gamble* says wood greyish brown or olive grey, moderately hard, shining, close and even-grained, seasons well, durable, is not attacked by insects and that the bark is used for external application for sprains and bruises. Weight 45–48 lbs.

The following are the principal varieties or forms occurring in the province :—

Var. *α*, *sebifera* proper. L 2-5·5″ elliptic with rounded apex, often somewhat pubescent or thinly fulvous hairy beneath, base acute or rounded, sec. n. 5-8 or more, often irregular and median forked about one-third way from the margin, petioles stouter than in next and with the shoots often permanently pubescent. Puri Division !

Var. *β*, *normalis*. L. 3-6″ oblong or lanceolate, obtuse to acuminate, usually tapering both ends, glabrous or sparingly pubescent beneath. Sec. n. rarely forked except near margin.

Ranchi, Manbhum, Hazaribagh, Puri, Cuttack, Bonai, etc.

The commonest form but not apparently the type according to *Sir J. D. Hooker*.

Var. γ, *glabraria*, *J. D. H.* L. attaining 8″, more or less tomentose beneath until the fruit is ripe. Common peduncles attain 1·5″ with numerous umbels. Frequent in Singbhum !

Var. δ, *longifolia*. L. up to 11″ by 3″ lanceolate. Petioles up to 1·4″, sec. n. 8-14. Common peduncles ·3-6″.

Angul ! Sambalpur !

2. **L. polyantha,** *Juss.* Porjo, Pojo, *K.*, *S.* ; Kukur chita, *Beng.* ; Baglal, *Mal. P.* ; Motwa, *Tharu* ; Barendo, *Khond* ; Bastura, *Or.* (f. *Cooper*).

A small tree with brown-pubescent branchlets, strongly-nerved ell.- or oblanceo.-oblong obtuse or sub-acute leaves 4·5″ by 2″ to 9″ by 4″ and tomentose stout-pedicelled umbels clustered along the branchlets and axillary. Fr. ellipsoid or ovoid ·25–·33″ long, seated on the shallow saucer-shaped perianth base which is ·12–·17″ diam.

In valleys, chiefly near streams, throughout the province but nowhere very common. Champaran ! Chota Nagpur (ascends to the top of Parasnath) ! Gaya ghats, rare ! Puri ! Angul ! Bonai, *Cooper* ! Fl. April-May. Fr. July-Aug. Evergreen. The leaves are renewed in May.

Bark smooth. Blaze somewhat grating, a mixture of brown and white. L. pubescent and glaucous beneath with 7-12 strong sec. n. and raised parallel cross nervules. Umbels 2-several in a cluster sometimes on a very short common peduncle, 5-6-fld. Special peduncle in fem. ·12-·33″ and fruiting pedicels ·25-·75″. Sepals usually 5, linear-oblong, nearly free. St. 9-13, fil. hairy, reduced to 2-glandular staminodes in fem. fl.

The powdered bark is applied to bruises of the body and to fractures in animals. The seeds yield an oil which is used medicinally. *Campbell*. "Powdered root used for bruises," *Cooper*. "Wood used for agricultural implements. Wt. 38 lbs.," *Gamble*.

3. **L. salicifolia,** *Roxb.*, var. laurifolia, *J. D. H.*

A bushy shrub up to 15 ft. high with numerous suberect shortly finely silky branches, alternate lanceolate or linear-lanceolate leaves 2·5–6″ long by ·5–1·4″ wide, dark green and shining above, glaucous and very minutely fulvous-silky beneath, sec. n. 7–13 distinct and pale (or reddish when dry) oblique, becoming faint and looping towards the margin, tertiaries scalariform, indistinct. Petiole ·25–·4″ clothed like the twigs. M. umbels clustered axillary and from the axils of deciduous bud-scales (whence they sometimes appear racemed), peduncles ·2–·25″, invol.-bracts ·15″ enclosing 5–4 flowers, tepals linear-oblong ·08″. St. 6–9. Fem. peduncles often solitary ·4″, invol. bracts concave orbicular-oblong 4–5, fls. 5 shortly pedicelled, pedicels silky, villose at top, staminodes twice as many as the tepals, elliptic-oblong hairy, inner with 2 glands as in the male. Ovary ovoid glabrous.

Purneah, in low forest! Fl. Dec.-Jan.

Stems attain 3″ diam., bark smooth, blaze rather hard, pale-brown. L. green beneath when dry. Involucre-bracts nearly glabrous or silky outside, gland-dotted, 5-nerved from the amplexicaul base, tepals 6-7, outer stamens half as long again as the tepals, filaments pilose, when 6 both series with glands, when 9 the two inner series with quadrate stipitate glands. Fruit (not seen in our specimens) ·3″ long, purple-black, ellipsoid, seated on the very slightly enlarged sub-cupular perianth tube.

4. L. nitida, *Roxb.*

A straight small or mod.-sized glabrous tree branched low down with large shining oblong to lanceolate leaves 12 by 3·5″, rarely some broadly elliptic and 3–4″ broad, and long slender-pedicelled umbels in axillary racemes. Fr. ·5″ red when ripe, invested by the enlarged fleshy cupular perianth which attains ·3–·4″ diam.

Deep valleys in the Saranda forests, Singbhum! Bonai, *Cooper*! Fl. June. Fr. Sept.–Oct. Evergreen.

A very distinct and handsome tree. Branchlets 5-angled or sub-alate, glossy, as are the leaves, some of which attain 14″. Nervation rather faint when fresh, very obscure between the 5–8 irregular sec. n. Petiole stout ·75–1·5″. M. racemes 1–4″. Fem. ·5–2″. Pedicels ·75″. Fls. about 4 in an umbel. Perianth-tube and filaments tawny pubescent. Tep. 4 unequal, glabrous, very glandular. Fruiting perianth often distinctly lobed.

It is said to be a useful timber tree in Silhet.

3. MACHILUS, *Nees.*

Evergreen trees with the characteristic laurel branching (*vide* description of family). Leaves alt. penninerved. Fls. 2-sexual, in panicles from leaf-scales and axils of the new leaves hence at first often appearing sub-terminal. Perianth of 6 free or nearly free persistent tepals, spreading or reflexed in fruit. Perfect st. 9, anthers 4-celled, those of the 3rd series extrorse, and 2-glandular. Staminodes of the 4th series cordate. Berry globose or ellipsoid seated on the persistent unaltered perianth, pedicel not swollen.

L. tawny-villose beneath. Petiole ·5–·7″	1. *villosa.*
L. glabrous, pale-glaucous beneath. Petiole ·7–1·3″ . . .	1. *macrantha.*

1. M. villosa, *Hook. f.* Atilo, *Or.*

A large tree 4–6 ft. girth but usually much branched with the leaves towards the ends of the branches 4–7″ tawny-villose beneath, especially on the strong sec. nerves. Fls. tawny tomentose in narrow panicles 3–4″ long. Fruit globose black ·4″ diam.

Mayurbhanj, along rivers elev. over 2000 ft. (Bhanjbassa)! Fl. April. Fr. May.

Bark dark grey, nearly smooth. Blaze very thick and soft, red. Shoots tawny tomentose. L. lanceolate, ell. or ell.-obovate acuminate glossy above and glabrous, base acute, sec. n. 7-9 very strong beneath oblique with numerous tertiaries more or less scalariform. Peti. ·5–·7″. Panicles at base of new shoots or subterminal (from cessation of growth of the shoot) racemiform or subcorymbose 3–4″, tomentose. Perianth campanulate (subglobose *F.B.I.*), tepals ·15″ elliptic-obovate, pedicels stout ·3″.

Gamble says of this species in the Eastern Himalaya and Upper Burma that it is a nice useful wood but the growth is slow, 11 rings per inch of radius.

2. M. macrantha, *Nees.* Syn. M. glaucescens, *Wight.*

A small or mod.-sized tree glabrous except the inflorescence. Mature leaves elliptic-oblong to elliptic-obovate 4″ by 1·5″ to 9″ by 2·8″ (on same twig), on flowering shoots often only 3–4″, base rounded,

obtuse or broadly cuneate, apex slightly tapering or shortly suddenly acuminate, beautifully white-glaucous beneath with 6–12 sec. n. often forked and always becoming fainter and looped with one another towards the margin, tertiaries reticulate and enclosing still finer minute reticulations. Petiole rather slender ·7–1·3″ long. Inflorescence tomentose 3–7·5″ in flower, up to 7″ in fruit. Tepals oblong or elliptic-oblong ·1–·13″ reflexed in fruit. Berries globose ·6″ diam.

Rare. Evergreen forests near ravines, ascending to Neterhat 3000 ft., Palamau ! Bonai (*Cooper*)! Fl. (in Southern India and Neilgherries, our specimens not in flower) Jan.–April. Fr. Jan. Evergreen.

Trunk smooth, about 3 ft. girth in our province. Buds short ovoid, glabrous. L. aromatic, microscopically dotted.

4. PHOEBE, *Nees.*

Characters of *Machilus* but perianth-tube more developed and tepals erect hardened and clasping the base of the fruit.

1. **P. lanceolata,** *Nees.*

A small tree with lanceolate caudate leaves 4–9″ with a very tapering base, glabrous or thinly pubescent beneath. Panicles axillary at base of the new shoots racemiform corymbose 2–5″ with very long slender peduncles. Perianth ·15″ long, hardening and clasping the base of the narrowly ellipsoid black fruit.

Mayurbhnaj, above 2000 ft. ! Bettiah and Ramnagar Forests ! Fl. April–May. Fr. May–June.

Bark grey, nearly smooth. Blaze thick brownish or carneous. Twigs brown with persistent leaf scars and lenticels, glabrous except when very young. L. with 6–11 fine distinct sec. n. but rather irregular and some intermediate nearly as strong, tertiaries close reticulate and sub-scalariform, the mid-rib and sec. n. brownish. Peti. ·4–·8″.

5. CINNAMOMUM, *Blume.*

Evergreen trees or shrubs with opp. or alt. usually 3-basal-nerved leaves. Fls. in axillary and terminal panicles often polygamous with females larger. Hypanthium short. Tepals 6 subequal. Stamens 9, or sometimes fewer, in three whorls, 4th whorl of 3 staminodes. Fruit seated on the enlarged hypanthium.

Cultivated species only in B. & O.

1. L. opp. or subopposite with 3-nerved base. Buds scarcely perulate :—
   - L. reticulate beneath. Panicles exceeding the leaves . . 1. *multiflorum.*
   - L. not reticulate. Panicles scarcely larger than the leaves . 2. *tamala.*
2. L. alternate, penninerved, or 3-nerved considerably above the base. Buds very perulate . . . . . 3. *camphora.*

1. **C. multiflorum,** *Wight.* Cinnamon Tree.

A small or medium sized tree with ovate, ovate-ell. or ovate-lanc. glabrous leaves 2–4″ and panicles 3–7″ long of small flowers ·15″ long. Easily recognised by the marked cinnamon flavour of the bark on the twigs.

Occasionally cultivated in gardens towards the Ganges, *e.g.* Pirpainti ! Fl. Jan.–Feb. Native of Ceylon.

L. obtuse or acute scarcely acuminate, old glabrous. Panicles much branched. Pedicels, tepals both sides, filaments and stalks of glands and staminodes shortly silky. Ovary glabrous.

This is united by *Thwaites* with the common Cinnamon (*C. zeylanicum, Breyn*), which has leaves 4–7″ long, shorter panicles, and flowers ·25″ long.
The latter is probably also cultivated occasionally in the province, but I have not seen it.

2. C. tamala, *Fr. Nees.* Tejpat, *H., Beng.*; Sisi, *Th.*

A moderate sized tree with leaves usually 4–5″ long shining above, mostly oblong. Fls. ·2–·25″ long. Tepals deciduous in fruit. Stamens and ovary villous.

The leaves are often sold in the Bazars, but it is very rarely cultivated in B. & O. Native of the tropical and subtropical Himalaya and no doubt occurs wild in the forests just north of our boundary.

3. C. camphora, *F. Nees.* The Camphor Tree.

A small tree with dark-grey rough bark on the trunk and branched low down. Buds perulate with branching of the characteristic laurel type. Buds small ovate distinctly perulate. Leaves 2·5–4″ long, elliptic-lanceolate or somewhat ovate, acuminate, dark-green above with a whitish or glaucous waxy coating beneath, glands not externally visible, triple-nerved at a considerable distance (·25″ or more) from the base, other sec. n. about 2 slender. Petiole long and slender ·7″ or up to half as long as blade. Flowers very sweet-scented, whitish, ·17–·2″ diam. in small pseudo-terminal panicles with the branches 1–2″ long; yellow glands on the inner stamens very conspicuous. Berry sub-globose black.

Occasional in gardens in the damper districts. Fl. March-May. Very slow growing in our area.
The leaves have a pleasant aromatic odour when crushed, but not more camphoraceous in character than many other laurels.

6. BEILSCHMIEDIA, *Nees.*

Usually evergreen trees with penninerved alt. or opp. leaves and small bisexual fls. solitary and in small lateral panicles on the new shoots. Per. tube short. Stamens sub-perigynous, filaments of innermost series of perfect st. 2-glandular at base with extrorse anthers; anthers 2-celled; staminodes ovoid or cordate. Fruit from globose to very narrowly oblong or obovoid. Perianth quite deciduous in fruit.

Large tree. L. oblong to oblong lanceolate, 3–6″	1. *Roxburghiana.*
Small tree. L. ell.-oblong or narrowly elliptic, 5–9″ . . .	Var. *Dalzellii.*

1. B. Roxburghiana, *Nees.* Syn. B. fagifolia, *Nees*; Katea-ratam, Katea-u:, *K.*

a. Var. **fagifolia,** *Nees* (sp.).

A large dark-foliaged tree attaining 6 ft. girth with rather smooth light bark, linear-oblong or oblong-lanceolate obtuse or slightly acuminate leaves 3–6″ by ·62–1·75″. Flowers in very short panicles ·5–·75″ long from the leaf-scars and from the axils of caducous scales of the new shoots or from the axils of the new leaves. Fruit narrowly oblong-obovoid purple-black, 1–1·75″ long.

Along rivers in Singbhum and Porahat (Deo R., Rangan gara, Saikata gara, etc.), not common! Fl. March-April. Fr. May. Renews leaves April.
Leaves tapering at the base, some slightly obovate and attaining 7″ by 2·7″;

sec. n. 6–12, intermediate very reticulate and fine, raised both sides. Petiole ·33–·75″. Panicles villosely-pubescent. Tepals variable in size, ·09–·17″ long, linear-oblong to oblong-oblanceolate, pubescent both sides. Perfect stamens in 3–4 series, staminodes white fleshy, sometimes 2-seriate. Testa rather coriaceous.

It is said to be a good timber.

B. fagifolia was united with *B. Roxburghiana* by *Brandis* (*Forest Trees*), who, however, did not even maintain *fagifolia* as a variety.

β. Var. **Dalzellii,** *Meissn.* (sp.).

A small tree (in our area) with green branches, alternate and sub-opposite shining elliptic-oblong to elliptic gland-dotted leaves 5–9″ by 1·75–3″ narrowed both ends but scarcely acuminate.

Along streams in the Santal Parg.! Fl. and Fr. not seen.

Sec. n. about 7, distant, tertiaries obscure till dry, then they stand out on both sides as fine reticulations as in the last. Buds pubescent.

It greatly resembles *B. assamica*, *Meissn.*, but for its short pubescent buds. *B. assamica* has lanceolate glabrous ones. It may possibly be the type, but that has acuminate leaves. The type has panicles 1–1·5″ long and fruits 2″ long.

7. CRYPTOCARYA, *Br.*

Evergreen trees with alternate penninerved (in our species) leaves and small 2-sexual flowers in axillary and subterminal, or on short shoots terminal, panicles. Perianth sub-campanulate with the tube as long as the tepals accrescent and closely investing the fruit of which it becomes a part. Perfect stamens 9, 6 with introrse 2-celled anthers, those of the third series 2-glandular with 2-celled extrorse anthers, 4th series consisting of stipitate staminodes.

1. **C. amygdalina,** *Nees.* Dhual, *Or.*

A moderate sized tree with brown-pubescent twigs, broadly oblong or elliptic strongly nerved leaves 3–5″ long and axillary and terminal lax panicles 3–6″ long of small tomentose flowers ·13″ long, articulate at base. Fruit (not seen in our area, in Duars specimens) strongly ribbed when very young, finally smooth ellipsoid ·7–·75″ long.

Southern Range, Puri, elev. 1500 ft.! Fl. March–April. Fr. May.

Leaves rounded, truncate or with a short cusp, base subacute sometimes unequal, beneath pale and microscopically glandular, midrib strong brown, sec. n. 5–9 strong glabrescent curved at the margin, tertiaries close scalariform. In Duars specimens the leaves are sometimes 7″ long and often narrowly elliptic. Petiole ·4–·7″ subrugose. Panicle-branches 1–3″ in flower pubescent or tomentose, whole panicle often enlarged in fruit. Perianth-tube obconic in flower, mouth nearly closed in fruit, tepals ovate-oblong. Third series of stamens on throat of tube each flanked by a fleshy scale, staminodes 3 lanceolate subsessile on the fulvous-pubescent throat, filaments of perfect stamens pubescent.

8. CASSYTHA, *L.*

A filiform leafless parasite attaching itself by means of haustoria to *Sal*, *Carissa* and other bushes, resembling *Cuscuta*, but much greener. Fls. sessile ·08″ white, with 3 broad ovate imbricating bracts at base, in spikes ·5–1·5″ long.

Throughout Chota Nagpur, locally abundant esp. near Chorparan in Hazaribagh, chiefly on *Carissa*, *Holarrhena*, *Zizyphus* and *Sal*! Puri, common on the fleshy *Euphorbia* and very common in the Khurda scrub jungles! Very common in the Sambalpur range in some of the coppice areas on *Phyllanthus*, *Jamun*, and running through the grass, where it becomes a serious pest! Fl., Fr. most of the year.

Stems pubescent or glabrous. Spikes pubescent from the axils of scale-leaves. Outer perianth-lobes small orbicular ciliate, inner oblong glabrous valvate. St. 3-seriate. First series petaloid with 2 cells adnate to linear face; second series smaller, similar, dilated below; third series hastate with 2 glands on the very short filament. Staminodes 3 fleshy. Ovary tapering to a minute capitellate stigma. Berry ·25-·4″ diam. including the white succulent accrescent perianth.

It is noticeable that *Cassytha* and *Cuscuta* are seldom found in the same locality

FAM. 116. HERNANDIACEÆ.

Trees or shrubs with alternate, often peltately attached and palmately-nerved, simple entire or lobed exstipulate leaves; usually abounding in oil-glands and sometimes also with cystoliths and capitate hairs. Flowers small in axillary or pseudo-terminal cymes or panicles, 2-sexual or monœcious, regular, with 3–many- (rarely 2-) partite perianth with the valvate tepals usually evidently 2-seriate. Stamens as many as and opposite to the outer tepals, 1-seriate, with 2-celled anthers opening by lateral recurved valves, glands or staminodes sometimes present alternating with the stamens. Ovary inferior, 1-celled, with one pendulous anatropous ovule. Fruit sometimes winged, indehiscent.

1. GYROCARPUS, *Jacq.*

Leaves clustered towards the ends of the branches. Flowers 1-sexual, clustered in cymose panicles without bracts. Males very numerous, perianth 4–7-partite, stamens 4–7 with as many alternating clavate glands. Female or hermaphrodite flowers few, tepals 2 accrescent and coriaceous in fruit. Style 0. Fruit a bony nut crowned by the spathulate wing-like tepals. Seed with convolute cotyledons.

1. G. americanus, *Jacquin.* Syn. G. Jacquini, *Roxb.*

A tall tree with brown branches and pubescent or tomentose shoots. Leaves broadly ovate acuminate, with base cordate rounded or shortly cuneate, in young plants deeply lobed, 3–5·5″, principal nerves 3 of which lateral usually soon forked, sec. n. 2–3. Petioles 2–5″. Flowers white, densely hairy in cymes 2–3″ broad and several together from the ends of the twigs on long pubescent peduncles. Fruit globose wrinkled ·5–·75″, wings striate pubescent 2–3″ obcuneate or oblanceolate with rounded apex.

Mals of Orissa, very rare (only once seen), *Gamble*! Fl. Jan.-Feb. Fr. April. Decid. Dec.-Jan.

Bark smooth, shining, greenish white.

FAM. 117. PROTEACEÆ.

Trees or shrubs, rarely herbs, with alternate, rarely subopposite or whorled, simple or variously divided, mostly coriaceous, exstipulate leaves. Flowers often showy, 2-sexual, single or paired in the axils of bracts, usually in spikes, racemes, heads or umbels, often irregular. Perianth inferior, segments 4, at first valvately cohering in a cylindric

tube gibbous at the base, with free recurved tips. Stamens 4, shorter than and adnate to the tepals on which they often appear inserted, anthers erect, 2-celled, introrse. Hypogynous glands or scales often alternating with the stamens. Ovary 1-celled, often oblique; terminal style with thickened tip; stigma terminal or lateral. Ovules 1 or 2 or many and 2-seriate. Fruit various. Seed exalbuminous, cotyledons often unequal, radicle short inferior or lateral.

A large family, of which over half the species are Australian and none indigenous in our area; only one genus (*Helicia*) is Indian.

1. GREVILLEA, *R. Br.*

Trees or shrubs with variously shaped, sometimes pinnatifid leaves and regular or zygomorphic flowers paired in the axils of bracts of elongated rarely contracted racemes. Perianth-tube straight or dilated at the base and often recurved under the limb, tepals for a long time connate. Anthers sessile. Ovary stipitate or subsessile with 2 collateral laterally affixed amphitropous ovules. Fruit usually follicular. Seeds 1–2 often winged.

1. **G. robusta,** *A. Cunn.* The Silver Oak; Silky Oak.

A large handsome tree with fern-like twice-pinnatifid leaves silvery beneath and unilateral racemes of orange flowers with slender pedicels. Follicle ·6–·75″.

Very commonly cultivated. Seeds freely. Fl. March-May. Native of eastern Australia.

FAM. 118. ELÆAGNACEÆ.

Shrubs or trees with numerous silvery or brown scales and alternate or opposite entire exstipulate leaves. Flowers small or mod.-sized, green, white or yellow, in axillary fascicles or cymes, regular, 1–2-sexual, with tubular 2–6-cleft perianth, the lower part sometimes thickened in fruit. Stamens adnate to the perianth-tube and twice as many as the lobes or in the 2-sexual flowers as many as the lobes and opposite to them, perigynous. Ovary free in lower part of tube but closely invested, 1-celled with filiform style and lateral stigma. Ovule 1, basal, erect, anatropous. Fruit indehiscent enclosed in the perianth-tube. Seed ascending with scanty or 0 albumen. Embryo straight axile; cotyledons thick; radicle inferior.

1. ELÆAGNUS, *L.*

Perianth-tube oblong or globose, constricted above the ovary, limb valvately 4-cleft, deciduous. Stamens 4 on the mouth. Style linear, included. Fruit a nut consisting of the lower often accrescent part of perianth-tube or hypanthium as well as the developed ovary.

1. **E. latifolia,** *L.*

A rambling bush with strong straight or reflexed thorns below and mostly elliptic leaves 2–4″ beautifully silvery beneath, sec. n. about

5 straight fine. Petiole ·1–·25″. Flowers yellowish-green or greenish-white clustered, only ·3″ long at first, scaly and pubescent, lengthening by the growth of the portion surrounding the ovary and part above constriction finally deciduous. Fruit ·75″ oblong-ellipsoid, ribbed.

Mals of Puri! Fl. Nov. Fr. Jan. Evergreen.

FAM. 119. LORANTHACEÆ.

Green parasitic shrubs attaching themselves by means of haustoria to the branches of other woody plants, with opposite or alternate simple entire leaves or leaves reduced to scales and their functions assumed by the often flattened green branches. Flowers from small, regular to brightly coloured and a tendency to zygomorphy, 1–2-sexual, usually bracteate and often 2-bracteolate, in racemes, spikes or fascicles. Hypanthium adnate to the ovary and sometimes growing up as an entire or toothed ring ("calyculus") above it. Perianth sepaloid or petaloid of 4–6 tepals free or connate into a tube below, valvate in bud. Stamens as many as the tepals, opposite to and usually adnate to them. Ovary inferior, 1-celled, style short or long, stigma simple. Ovule and placenta not differentiated, completely filling the ovary, with usually 1, rarely 2–3 embryo sacs. Fruit baccate, rarely drupaceous, with a viscid inner layer, by means of which it becomes adherent to the future host.

Calyculus present.* Flowers 2-sexual, often showy . . .	1. *Loranthus.*
Calyculus 0. Flowers 1-sexual, green or yellowish	2. *Viscum.*

1. LORANTHUS, *L.*

Leaves opposite or alternate, usually broad. Flowers 2-sexual, green or coloured. Hypanthium usually produced into a calyculus which is sometimes reduced to a mere rim. Tepals free or perianth forming a split or entire tube below, lobes reflexed or spreading. Stamens epiphyllous, anthers versatile or cells adnate, parallel.

A. Calyculus broadly tubular. Flowers distinctly racemed:—	
Flowers 1″ or more. Bracteoles 0	1. *longiflorus.*
Flowers ·5″, angled. Bracteoles present	2. *globosus.*
B. Calyculus a mere rim. Flowers in tomentose fascicles or very short racemes:—	
Leaves under 3″ broad, base usually cuneate	3. *scurrula.*
Leaves mostly over 3″ broad, base cordate	4. *cordifolius.*

1. L. longiflorus, *Desr.* Banda, *H.*, *S.*; Sum, *K.*; Madung, *Or.*

A woody branch-parasite with glabrous branches and usually broad, but variously shaped, opposite or alternate, sessile or shortly petioled, thickly coriaceous, glabrous leaves mostly about 3–6″ long. Flowers showy scarlet and orange or sometimes pink, 1–2″ long, in axillary and extra-axillary secund racemes 1–4″ long. Hypanthium with calyculus, ·1–·15″, calyculus distinct broadly tubular usually truncate or only faintly toothed. Perianth slender tubular split at the back and slightly curved with 5 linear-oblong often green lobes ·3–·4″ long. Fruit oblong ·5″ crowned with the calyculus.

* A mere rim in some species.

The commonest *Loranthus*, found on a large variety of trees and throughout the province. In the Ghichamura Sal forest in Sambalpur nearly every pole was at one time infested with this parasite. Fl., Fr. Nov.–March.

L. mostly elliptic or ovate, obtuse or rounded, base sometimes amplexicaul, midrib often red, with obscure secondary nervation. Racemes and hypanthium pubescent or puberulous. Bract suborbicular ·06″; bracteoles 0. Perianth tube somewhat expanded upwards. Anthers linear.

2. **L. globosus,** *Roxb.*

A glabrous shrub with opposite elliptic-lanceolate acute or subacuminate coriaceous leaves 2–4″ long, obscurely nerved when green, and greenish-orange flowers about ·5″ long before the reflexion of the tepals, in 3–7-fld. short racemes ·5–·75″ long axillary and from the leaf-scars. Perianth-tube oblong 5–6-angled and inflated, with 5–6 linear-spathulate lobes nearly as long as the tube. Fruit globose, yellow (*Roxb.*)

Manbhum, *Camp.*! S. P., *Chattarjee*! Probably also Purneah. Bengal (without locality) *Herb. Kew. Roxburgh* says "common on trees throughout Bengal," but it is only common in the eastern parts, and has been collected by me just east of our area in Jalpiguri district together with *L. ampullaceus, Roxb.*, which *Hooker* considers a form of the same species. Fl., Fr. h.s. or (*fide Roxb.*) all the year.

Leaves with 5–8 very fine sec. n. easily visible when dry as are the finer tertiaries. Petiole ·2–·3″. Flowers with a broadly ovate bract ·06″ long and 2 similar rather smaller bracteoles connate with one another about half-way up. Hypanthium with calyculus ·15″ long, truncate. Ridges sharp extending whole length of the perianth in bud and with triangular projections about middle of the tube. Anthers short oblong truncate, much shorter than free part of filament.

3. **L. scurrula,** *L.* Huring sum, *K.*; Banda, *H.*, *S.*

A tufted shrub with very lenticellate branches, young parts with a brown or hoary stellate or scaly tomentum. Leaves ovate-oblong, ovate or elliptic, opposite or some alternate, young rusty, mature often glabrous, 2–4″ by 1–2·5″. Base often cuneate and somewhat decurrent on the ·3–·6″-long petiole. Flowers ·5–·7″ long before the reflexion of the tepals, fascicled or in short contracted racemes, tomentose, greenish with bright-red filaments. Bracts minute and bracteoles 0. Fruit clavate or pyriform ·3″.

Perhaps as common as *L. longiflorus*, but usually on low trees and shrubs, esp. common on *Woodfordia* and *Wendlandia*. Plains of Behar, *J.D.H.*! Chota Nagpur, all districts, common! Santal Parg.! Narsingpur! Fl. Oct.–Jan. Fr. Dec.–Jan. New shoots in Jan.

L. obtuse or subacute with 4–5 faint sec. n. Rhachis of inflorescence mostly under ·25″. Hypanthium scarcely produced into a calyculus. Perianth tomentose ·5″ or less, tube curved, inflated, split; lobes linear 4, ·12–·17″ long, anthers linear ·07″.

When quite ripe the outer covering of the fruit consisting of an epidermis, a parenchymatous tissue with little chlorophyll and an inner sheath of very minute cells becomes detached leaving a somewhat 4-gonous clavate body, probably the seed. This has an outer transparent very small-celled layer and an inner thicker tissue very rich in chlorophyll which secretes mucus.

4. **L. cordifolius,** *Wall.* Ichac banda, *S.* (which merely means the parasite of *Woodfordia*).

As *Sir J. D. Hooker* remarks, this is scarcely more than a variety of *L. scurrula*, differing in its greater size, more rounded and cordate leaves and the more copious white tomentum.

Hazaribagh! Manbhum, *Camp.*!

I would include this in *L. scurrula*. L. broadly elliptic to ovate, 2–2·5″, with rounded or cordate base. Petiole ·4–·5″.

2. VISCUM, *L.*

Parasitic shrubs with the leaves opposite or reduced to scales. Flowers 1-sexual, small or minute, solitary or fascicled. Hypanthium solid or hollow in the male, adnate to the ovary in the female, tepals 3–4, green or yellow. Anthers sessile, adnate to the tepals, opening by many pores. Ovary inferior, stigma large pulvinate. Fruit succulent baccate. Embryo in fleshy albumen, solitary or 2 in each seed.

A. Branches leafy:—
Leaves lanceolate or elliptic acute, neither very thick nor venose. Bracts not cuspidate. Fruit oblong, pericarp not dotted . . . . . 1. *monoicum.*
Leaves mostly broad and obtuse. Lower bracts usually cuspidate. Fruit subglobose, pericarp with lines of raised dots 2. *orientale.*
B. Branches flattened, leafless . . . . . 3. *articulatum.*

1. **V. monoicum,** *Roxb.* Vern. Banda (often with the name of the host tree prefixed).

A tufted shrub with slender terete branches compressed at the ends and narrowly elliptic or lanceolate acute leaves, often a little falcate, with 3–5 slender principal nerves. Flowers few at the nodes in groups of 3–1 between a pair of concave ovate bracts ·04–·05″ long with rounded tips, subsessile, with 1–2 similar pairs of bracts below the floral. Tepals 4. Berry shortly stipitate oblong ·25″, green polished with few longitudinal white veins.

Manbhum (on *Helicteres*), *Camp.*! Ranchi, *Wood* (*Pitorea*); Santal Parganas! Fl. Nov.–Dec. Fr. Jan.

The branchlets may become angled and grooved on drying as in the next, but the leaves are far less opaque and venous.

2. **V. orientale,** *Willd.* Vern. as in last.

A densely branched shrub with the branches frequently 2–3-chotomous or 3–4-nately whorled terete or flattened above, ridged and channelled when dry. Leaves very coriaceous, ovate, ovate-lanceolate obovate or elliptic-oblong, usually rounded or obtuse, base equal or oblique narrowed, subsessile, 3–5-nerved and with many nervules (best seen when dry), 1·5–3″ long. Flowers green or yellow, often very numerous (up to 17) at the nodes, in sessile bracteate cymose fascicles, very short branches of fascicle with pairs of bracts all or the lower very often with a short cusp, ultimate pair of bracts short broad conniving at their base, often rounded, ·05–·07″ long bearing 2–3 flowers, male and female usually mixed. Berry broadly ovoid or globose but apparently often ellipsoid when young, ripe pericarp with lines of minute raised dots at least when dry.

Frequent on *Zizyphus*, *Croton*, *Erycibe*, and other trees and shrubs. Throughout Chota Nagpur! Angul! Fl., Fr. more or less throughout the year.

Key characters for the separation of this species and the last are very difficult. The branches are sometimes, at any rate, *not* grooved when fresh, the shape of the leaves is variable, the cuspidation of the bracts is not evident in my only specimen with good male and female flowers, the minute warts on the pericarp are not present when young, and it seems that when they are this constitutes the *Viscum verrueulosum*, *W. & A.* The texture of the leaves appears to be the only constant mark of distinction with their many nervules.

The leaves have a matt surface with the edges often slightly crimped. Male fls. ·07″ long, tepals 3-4 triangular obtuse exceeding the hollow hypanthium.

anthers about as broad as long. Female ·08″ long, tepals rather shorter than the hyp., connate at base triangular-lanceolate. Margins of bracts papillose (as they are in *V. monoicum*).

3. V. articulatum, *Burm.*

A shrub with sap-green striate, often subverticillate, flattened branches contracted at the nodes with leaves reduced to scales. Internodes 1–2″ long by ·1–·25″ broad. Flowers minute, fascicled at the nodes, few or many in connate cupular bracts, 3–4-merous. Fruit subglobose, yellow, smooth.

Common in all districts of Chota Nagpur, ascending to Neterhat (3000 ft.), chiefly on *Diospyros* and *Bassia*! Fl. Dec.–Jan.

FAM. 120. SANTALACEÆ.

Trees, shrubs or herbs, often parasitic on roots (usually hemiparasites only). Leaves alternate or opposite, entire, sometimes scale-like or 0, nerves inconspicuous, stipules 0. Flowers usually inconspicuous, regular, variously arranged, 1–2-sexual. Perianth superior or perigynous, 3–8-toothed, -lobed, or -partite, lobes with often a tuft of hair behind the anthers. Stamens 3–6 often adnate to the lobes, rarely at the base of the perianth opposite to the lobes, anthers 2-celled. Disc perigynous or epigynous. Ovary nearly free or usually adnate to the hypanthium, 1-celled, style usually short, stigma entire or 3–6-lobed. Ovules 2–3, adnate to or pendulous from a central column. Fruit a drupe or nut. Seed globose or ovoid; testa thin or obsolete, albumen copious, fleshy. Embryo usually terete.

Slender herbs. Flowers axillary or spicate . . . . . 1. *Thesium*.
Shrub. Flowers panicled . . . . . 2. *Santalum*.

1. THESIUM, *L.*

Slender herbs, rarely shrubby, "parasitic on roots." Leaves alternate, narrow, decurrent, 1–3-nerved. Flowers minute, greenish or white, solitary, axillary or spicate or in 2-chotomous cymes, 2-sexual. Perianth-tube produced above the ovary with 5, rarely 4, tepals which are hairy behind the anthers. Stamens inserted at the base of the tepals, included. Ovary quite inferior. Ovules 2–3, pendulous from a basal often flexuous or crumpled column which is free (according to the books consulted) or suspended in a thin-walled parenchyma (in our species) which fills the ovarian cavity. Fruit a drupe or nut, often ribbed. Embryo terete.

1. T. unicaule, *Haines* (*Journ. As. Soc. Beng.*, xv, 7, p. 316).

An erect weak pale-green herb about 1 ft. high with very slender glabrous stems and numerous alternate linear-acicular leaves, the lower about 1–1·5″ long, upper smaller bearing green sessile 2-bracteate flowers ·12″ long in their axils. Flowers with their two linear bracts adnate to the base of the leaf in fruit, becoming bottle-shaped.

Among wet grass in valleys. Chota Nagpur elev. 3000 ft.! Fl., Fr. April-June. The roots appear to be annual and there is nothing to show that it is parasitic on a cursory examination.

Flowers at first cylindric with 4 fleshy oblong tepals ·02″ long with white margins, slightly villous within and with some hairs behind the anthers attaching them to the tepals, which are hardened and incurved in fruit. Ovary sunk in the hypanthium, filled with parenchyma, column a slender flexuous thread bearing at its top 3 microscopic ovules, wall of ovary rapidly hardening in fruit which is a globose drupe venose when dry, the parenchyma becoming converted into white perisperm. Embryo most minute, tapering towards the superior radicle, with 2 very minute cotyledons.

A remarkable species. The fruit develops very rapidly, flowers being only found in the axils of immature leaves, which as they grow carry forward the fruit a short distance from the base and with the spreading bracts appear 3-foliolate. It appears closely allied to *T. himalense*, *Royle*, which *Royle* says "I found on the arid rocky soil near Choupal, to the north of Choor," and therefore in a very different kind of habitat.

2. SANTALUM, *L.*

Trees or shrubs with opposite rarely alternate coriaceous leaves and small 2-sexual flowers axillary or in terminal 3-chotomous paniculate cymes. Bracts minute. Hypanthium more or less adnate at the base to the ovary, campanulate, bearing 4, rarely 5, valvate tepals and lined by a fleshy disc terminating in 4 fleshy scales alternating with the tepals. Stamens perigynous on the margin of the disc opposite to the tepals. Ovary at first nearly free, becoming half-inferior in fruit, with elongate style and 2–3-lobed stigma. Ovules 2–3 reflexed on a long acuminate free central column. Fruit with the accrescent hypanthium drupaceous. Seed subglobose, embryo terete slender.

1. S. album, *L.* Chandan, *H.*; Sandal-wood.

A small glabrous evergreen tree, a hemi-parasite on the roots of a variety of trees. Leaves opposite 1–2·3″ long, ovate-lanceolate or elliptic, acute or subacute. Flowers small, at first pale then deep crimson, ·18″ diam. with rotate ovate tepals. Disc-lobes very thick. Stamens free from the tepals or only loosely adhering dorsally by the tuft of villi which grow up from the perianth at their base. Fruit a fleshy globose shining black drupe annulate at the top with the margin of the hypanthium.

Collected by the *Rev. A. Campbell* on Parasnath! Introduced by *Mr. Mudaliar* into Sambalpur a few years ago!* Fl. Sept.–Dec., also March. Fr. March-April, also Nov.

Santal takes about 2 months to germinate.

FAM. 121. BALANOPHORACEÆ.

Low fleshy leafless or scaly brown, reddish or yellow root parasites (or sometimes saprophytes ?), without stomata. Flowers monœcious or diœcious, small or minute, crowded on spadix-like peduncled globose or elongate heads, peduncles very stout, simple, arising from an amorphous tuberous or branching annual or perennial rootstock. Male perianth of 3–8 valvate tepals or 0, sometimes much larger than

* *Mr. Mudaliar* wrote a short article on this subject to the *Ind. Forester* (July, 1917, p. 318).

the female flower, stamens as many as the tepals and opposite to them, or filaments connate in a solid column with anthers connate or free or anthers sessile in a mass, or in the naked flowers stamens 1–2 only; anthers 2–many-celled, opening by pores, slits or valves or irregularly. Fem. perianth 0 or confluent with the ovary, limb 0 or minutely toothed. Ovary 1–3-celled, styles 1–2 or 0, stigmas simple or capitellate, rarely sessile and pulvinate. Ovule 1 in each cell, usually pendulous from the top, atropous or anatropous, naked or with a single integument or reduced to an embryo-sac. Fruit minute, crustaceous or coriaceous, 1-seeded. Seed usually adherent to the pericarp, testa thin or 0, rarely thick, albumen granular and oily, rarely floury. Embryo most minute, undivided.

1. BALANOPHORA, *Forst.*

Glabrous fleshy herbs with a tuberous rootstock warted with lenticels, abounding in a waxy secretion. Peduncles bursting through the rootstock which forms an irregularly or sub-regularly lobed or toothed ring or short sheath at its base. Flowers small or very minute, males comparatively large, monœcious or dœcious, often intermixed with swollen or clavate bodies (function unknown, usually exceeding the ovaries). Male perianth of 2–6 valvate tepals; stamens 2–many, filaments 0 or connate in a column, anthers free or connate. Fem. perianth 0. Ovary ellipsoid, 1-celled, narrowed into a slender style with terminal simple stigma, ovule 1, pendulous. Fruit minute, crustaceous. Seed adhering to the pericarp, albumen oily. Embryo subglobose of 2–3 cells only.

Engler states that the waxy resin in the *Balanophoræ* is so abundant that they burn with great brilliancy.

1. B. polyandra, *Griff.*

Rootstock tuberous, lobed, the peduncles each breaking through a rounded closely lenticellate lobe which becomes cup-shaped and embraces the base of the peduncle with a subregularly lobed sheath. Peduncles 3–6″ high, several, clothed with few large oblong-lanceolate imbricating and sheathing scales. Peduncle monœcious swollen at the end into a clavate head 1–2″ long bearing few large male flowers at its base, and densely crowded above these small stipitate knob-shaped protuberances, each surrounded by most minute female flowers. Male perianth ·15–·2″ diam. with 4, occasionally 6, tepals, posterior and anterior tepal broadly oblong, lateral smaller, androecium a fleshy mass with numerous confluent anther-cells. Fem. a shortly stipitate fusiform ovary ending in a hair-like style.

On roots of trees. Palamau: Neterhat; elev. 3000 ft.! Santal Par.: Mahuagarhi, *Gamble*! Fl. Sept.-Oct.

In the description of *B. polyandra* in *F.B I.* the male heads are described as cylindric and the female heads as ovoid or oblong, from which it appears that the species is sometimes dioecious or at any rate that the peduncles are 1-sexual.

FAM. 122. ULMACEÆ.

Trees, more rarely shrubs, with 2-farious, simple, often unequal-sided leaves, frequently dotted with cystoliths (the cystolith cells

sometimes visible when fresh as *translucent* dots). Stipules lateral or intrapetiolar, although not usually amplexicaul often leaving a circular scar or raised line round the branches and stems (as in the Moraceæ). Flowers mostly small, in axillary clusters or cymes, or females sometimes solitary, rarely all 2-sexual, usually polygamous, monœcious or dicœcious. Perianth usually 4–5-merous, polyphyllous or gamophyllous. Stamens isomerous to and opposite to the perianth lobes, rarely twice as many (*Holoptelea*), anthers erect in bud, dehiscence lateral. Pistillode usually present in male. Ovary of 2 median carpels, rarely 2-celled; stigmas 2 large, or style 2-fid or 4-fid, branches stigmatic on the inner sides. Ovule 1 pendulous, anatropous or amphitropous. Fruit indehiscent, a nut, drupe or samara. Seed with thin coriaceous testa, albumen 0 or scanty. Embryo straight or curved with flat or folded cotyledons.

Flowers clustered, appearing before the leaves. Fr. a samara	1. *Holoptelea*.
Flowers appearing on the young leafy shoots, axillary. Fr. a drupe:—	
Fls. polygamous, females often solitary. Cotyledons broad	2. *Celtis*.
Fls. unisexual, all cymose. Cotyledons narrow	3. *Trema*.

1. HOLOPTELEA, *Planch.*

Trees with the mature leaves mostly entire, penninerved, with scarious caducous stipules. Flowers fascicled at the leaf scars of previous year's shoots and appearing before the new leaves. Perianth campanulate cleft to the base with 4–8 imbricate tepals. Stamens diplostemonous or appearing more numerous from some of the tepals being permanently connate. Ovary compressed, style short 2-fid or 0, branches or stigmatic arms papillose within to the base. Fruit samaroid. Seed flat, exalbuminous. Embryo straight, cotyledons complicate.

1. **H. integrifolia,** *Planch.* Chilbil, *Kharw.*; Charha, Chorora, *S.*; Churla, *Mal-Pah.*; Dauranja, Gharanji, *Or.*

A large or small tree, in some states much resembling a beech. Leaves elliptic or ovate, mature usually entire, 2–4·5″ by 1·5–2·75″, translucent-punctate when green, with minute raised dots beneath when dry. Flowers green, in very numerous fascicles or abbreviated racemes on the leafless branches. Samara broadly elliptic, 1″, notched between the two stigmas, with a long stipes and slender pedicel.

Usually in valleys and on the banks of large rivers in the Central and Southern areas. Santal Par., occasional! Palamau, common! Manbhum and Hazaribagh, scarce! Puri! Angul! Fl. March or April: the flowers only last a few days on any one tree. Fr. end of May when the tree is in full leaf.

Attains 7 ft. girth with smooth light-coloured bark which becomes thick and flaky in very old trees, branches quite white, blaze cream streaked with light brown. Young shoots tomentose. L. usually glabrescent, sometimes somewhat obovate, entire or coarsely crenate or serrate (sometimes even in old trees), often shortly acuminate, base rounded oblique or somewhat cordate, sec. n. 5–7 raised beneath, very reticulate between, 1–2 close to base. Petiole ·3–·5″. Stipules linear, scarcely leaving a scar. M. and F. fls. in the same cluster, 4–8 merous but usually 5–6, tepals linear, pubescent.

Planchon distinguishes 3 varieties by their fruits but does not correlate these with the leaf-forms, of which there are several in our area which require further examination in fruit:—

α. **leiocarpa,** *Planch.* Branchlets with raised round lenticels, puberulous. L. under 3·5″, quickly glabrous (May), base oblique or rounded or a few subcordate. Petiole slender. Samara glabrous, deeply notched. Common.

β. **hebecarpa,** *Planch.?* Branchlets with few scarcely raised lenticels, glabrous or puberulous. L. mostly up to 5″ or 6″, rather membranous, glabrous or pubescent beneath (at least up to July), base subcordate or unequal. Petiole ·25–·3″.

The type of var. *hebecarpa* is *Wallich's* 3547 (*α*), in which the samaras are pubescent but the leaves are *glabrous*. *Hooker's* specimen from the banks of the Soane has glabrous serrate leaves and pubescent samaras, others have pubescent leaves.

γ. **tomentosa.** Twigs very pubescent or tomentose, hairs concealing the lenticels. L. coriaceous 3–4″, cordate, beneath tomentose with raised nerves, tip rounded or with very short obtuse cusp. Petiole ·5–·75″, stout. Samara probably pubescent (not noted).

δ. **fruticosa.** A shrubby form with very white bark, very tomentose. Probably a form dependent entirely on environment. Palamau hills!

The wood of *H. integrifolia* is not much used. "Wt. 40 lbs." *Gamble.*

2. CELTIS, *L.*

Trees or shrubs with alternate 2-farious entire or serrate palmately 3-nerved leaves. Flowers small cymose polygamous, male and 2-sexual cymes usually at the base of the shoots; female in the upper axils. Tepals 4–5 imbricate. Stamens isomerous surrounding a woolly torus. Ovary sessile, style with stout plumose simple or lobed arms. Fruit a small drupe with smooth or rugose endocarp. Albumen 0 or scanty. Embryo curved, cotyledons broad flat or bent inward or outward, surrounding the upcurved radicle.

Sec. n. 1-2 as strong as the basal. Drupes solitary or 2-nate . 1. *tetrandra.*
Sec. n. much weaker than the basal. Drupes 2-several on the peduncle . . . . . 2. *cinnamomea.*

1. C. tetrandra, *Roxb.* Chitimiti, *Kharw.*

A large tree with obliquely ovate or ovate-lanceolate, caudate, subentire crenate or serrate rather stiff leaves 1·5–3″, glabrous except for tuft of hair in the axils of the sec. nerves, sec. n. 2–3 fine but strong, one each side nearly reaching the apex. Petiole slender ·1–·2″. Fruiting peduncles simple, nearly always solitary, ·3–·4″, drupe broadly ellipsoid or ovoid, orange when ripe, ·25–·3″ long, glabrous with ovoid ridged otherwise smooth putamen.

Bettiah! Purneah! Along river at Adaye, Palamau, elev. 1500 ft.! Mayurbhanj, 3500 ft.! Fl. Feb. Fr. Oct.–Nov.

Attains 6 ft. girth and more with white or pale bark ringed by the accrescent faint stipular scars, bark on young twigs brown. Blaze hard, white with brown dots and lines; a chlorophyll layer is present in young bark. Twigs very slender. L. usually serrate above the middle.

2. C. cinnamomea, *Lindl.*

A tree with larger more membranous leaves than the last 2·5–4·7″ long, glabrous, shallowly serrate above the middle, basal nerves nearly reaching the apex, sec. n. on midrib short spreading much weaker than the lateral basal, 6–8 mostly joining the midrib and lateral basal. Petiole ·2–·4″ long. Stipules ·3″. Peduncles ·7″ with 2 or more ellipsoid drupes ·3″ long contracted at the apex, pedicels ·15″, fulvous hairy in flower.

Rocky ravines, Angul! Fr. (young) March–April. Evergreen, renewing leaves in March.

Possibly only a form of the last. The drupes in my specimens are not ripe. The larger leaves may be due to the moist warm locality, but the venation is different.

3. TREMA, *Lour.*

Usually small trees with the leaves serrate, 3–7-basal-nerved and often oblique. Stipules lateral caducous. Flowers small green, dicœcious, 1-sexual or polygamous in axillary cymes. Tepals 4–5, induplicate-valvate or subimbricate. Pistillode in M. 0 or small. Style in herm. or fem. 2-fid or stigmas 2. Drupe small seated on the persistent perianth. Albumen fleshy. Embryo curved or involute, cotyledons narrow, radicle upcurved, incumbent.

L. silky beneath, base oblique, mostly 3-nerved. Twigs adpressed-pubescent. Cymes lax . . . . . 1. *orientalis.*
L. tomentose or silky beneath, base oblique, mostly 3-nerved. Twigs with spreading pubescence. Cymes dense . . . var. *amboinensis.*
L. scabrid beneath, base sub-regular, 5-nerved . . . . 2. *politoria.*

1. **T. orientalis,** *Bl.* Syn. Celtis orientalis, *L.*; Chaur, *Th.*; Jhawar, *S.*; Roronga, *K.*; Rukni, *Kharw.*; Kokoara, *Mal. P.*; Kharkas, *Or.*

A small tree rarely over 35 ft. high in our area, with the trunk ringed with stipular scars. Branchlets with dense silky pubescence. Leaves ovate-lanceolate or lanceolate caudate 3–6″ long, mostly very oblique at the base, more or less white or silvery beneath with fine silky hairs, scabrid or nearly smooth above, serrulate. Dicœcious wherever I have seen it. M. cyme usually dense but sometimes lax and branched and up to 1·2″ long, tepals narrow oblong concave, torus woolly, pistillode obovoid. Fem. cymes usually lax, tepals flat, stigmas remote, tongue-shaped, papillose. Drupe yellow ·17″ long.

Chiefly in the Northern Area, along streams in the forests in the Central Area, rare in the Southern. Purneah, common! Champaran! Santal Parg.! Gaya Ghats, rare! Chota Nagpur, not common, all districts! Puri! Fl. Dec.–Jan. and April–May. Fr. Dec. (perhaps from the May flowering) and probably at other times, or perhaps Fl., Fr. Nov.–May. Evergreen.

Attains 5 ft. girth. Bark smooth white or pale, blaze deep red streaked. Leaf with usually 3 principal nerves, midrib with 2–5 strong oblique sec. n., tertiaries fine scalariform. Petiole ·2–·5″. Cymes bracteate, M. ·3–·7″. Fem. about as long but laxer.

Var. **amboinensis.** Syn. T. amboinensis, *Blume.*

There are two specimens named *T. amboinensis* in the Calcutta herbarium from our area, one from Manbhum and one from Parasnath, and I have also collected a similar one from Parasnath. They only differ from *T. orientalis* by the denser more spreading pubescence and denser male cymes. Another specimen collected by me in the Saranda Forests can be distinguished from the type by the beautiful whiteness of the leaves beneath (normal *T. orientalis* is silvery green), shaggy pubescence and the nervation often red.

The growth is very fast.

2. **T. politoria,** *Planch.* *Kaksi* (from the rough leaves), *K.*; Gar-Tila, *Kharw.*; Kharkas, *Or.* Also the same vernacular names as for *T. orientalis.*

A small tree attaining about 25 ft. in height with pubescent twigs, stiff oblong or oblong-lanceolate or some ovate-lanceolate leaves 2–3·7″

long, scabrid both sides and also hispid on the nerves beneath and with sparse short hairs above, obtuse acute or shortly acuminate, base nearly regular rounded or shallowly cordate, serrulate. Dicœcious. M. cymes shorter than or longer than the petioles up to ·5″, torus woolly or villous. Fem. cymes laxer with divaricate branches ·4–·5″.

Often on landslips, near roadside embankments, etc., apparently throughout the province, locally gregarious and short-lived. Champaran, in the hills! Santal Parg., frequent! Chota Nagpur, all districts, esp. along hill roads! Bonai, *Cooper*! Sambalpur! Kalahandi! In this species also there appear to be two flowering seasons, viz. Aug.–Sept. and April–May. Evergreen.

Attains 2–3 ft. girth only. Leaves with 5 basal nerves, midrib with 4–7 sec. n., tertiaries fine, reticulations not raised beneath, dots (due to cystoliths) usually easily visible both sides. Petiole ·1–·3″. Stipules subulate ·3–·4″. Cymes bracteate. Tepals oblong to linear, hispid, ciliate and dotted. Drupes much as in *T. orientalis*.

The rough leaves are sometimes used for polishing wood. The fruits are made into an acid jam.

FAM. 123. CANNABINACEÆ.

Shrubs or herbs, sometimes climbing, without milky juice, often secreting aromatic resins. Leaves opposite and alternate palmately nerved or palmately compound, with free persistent stipules. Flowers dicœcious. Males in a dichasium or panicle of dichasial cymes passing into scorpioid cymes, perianth 5-tepalous, tepals imbricate, filaments straight in bud. Pistillode 0. Female flowers in very contracted cymes or heads with large bracts, perianth entire reduced. Ovary 2-carpellary, 1-celled, with 2 large feathery stigmas. Ovule 1, pendulous anatropous. Fruit an achene. Embryo curved or spiral. Albumen present or 0.

1. CANNABIS, *Tournef.* Hemp.

Erect, with the lower leaves usually opposite and upper alternate, palmate, serrate. Male flowers in short pendulous cymose panicles; female crowded with leafy bracts, ultimate convolute, perianth hyaline embracing the ovary or suppressed. Style arms 2, filiform, caducous. Achene compressed, crustaceous. Seed flattened, albumen unilateral fleshy. Embryo curved, cotyledons broad thick subequal, radicle upcurved incumbent.

1. C. sativa, *L.* Ganja, Bhang, Charas, Siddhi, *Vern* (see below).

An annual, smelling, scarcely branched herb of very variable height but usually 3–5 ft. in its feral state, the female plant being generally supposed to grow taller than the male. Leaves 3–8″ diam., upper 3–1-foliolate passing into bracts, lower 3–8-foliolate with long petioles. Convolute bracts ·08″ long with oblique mouth much longer than the ovary and its investing hyaline perianth, accrescent and ·2″ in fruit.

Frequently growing subgregariously in Singbhum! Mayurbhanj! and other districts. Sometimes cultivated in Chota Nagpur and Puri. Native of temperate Asia (*De Candolle*).

Fl., Fr. c.s.

This plant is the source of the true Hemp fibre (as distinct from Sun hemp, Manila hemp, Sisal hemp, etc.) but it is not grown for its fibre in our area. Indeed the fibre is not of value in tropical and subtropical countries, whereas the narcotic resin is but little developed in colder climates. According to *Nadkarni*

"*Ganja*" consists of the unfertilised resinous flowering shoots of the female. "*Bhang*" or "*Siddhi*" consists of the dried leaves and fruiting shoots. *Bhang* or *Siddhi* is used in making the intoxicating liquor "*Hashish*" and the narcotic confection "*Majum.*" "*Charas*" is the resin which exudes naturally on the leaves, fissures in the stem, and fruits on plants grown in the mountains. *Siddhi*, *Subjie* and *Bhang* are synonyms and are used with water as a drink. *Ganja* is used for smoking (usually with tobacco). *Bhang* and *Ganja* are prescribed by native doctors in bowel complaints and as nervous stimulants. (See also *Watt*, *Dictionary of Economic Products*, and *Dutt*, *Materia Medica*.) Hemp can only legally be cultivated under licence, but *Bhang* can be collected from the wild plant. The cultivation of *Ganja* necessitates the removal of all the male plants, as the narcotic principle entirely disappears after fertilisation.

To the family Cannabinaceæ belongs also *Humulus lupulus*, the Hop.

Note.—The Euphorbiaceæ, usually placed before the Urticales, have been transferred to a position after the Malvales in view of the frequently dichlamydeous flowers.

The Urticaceæ of the *Genera Plantarum* have been divided into the four families of Ulmaceæ, Cannabinaceæ, Urticaceæ and Moraceæ.

FAM. 124. URTICACEÆ.

Annual or perennial herbs and undershrubs, rarely shrubs or trees, sometimes furnished with stinging hairs, sap watery. Leaves opposite or alternate, often bifarious and 3-basal-nerved, usually with opaque dots due to cystoliths. Stipules usually membranous, sometimes intrapetiolar. Flowers small greenish 1-sexual, monœcious or diœcious, in open or capitate cymes or cymules axillary or at the axils of fallen leaves, or lateral to and at the base of axillary shoots which may be abbreviated, leafless and spiciform. Perianth 4–5- seldom 2–3-merous, tepals free or united. Stamens in the males as many as the tepals and opposite to them, filaments usually broad and flat at the base, incurved in bud with anthers reversed and later elastically reflexed, anthers 2-celled with broad connective, dorsifixed; pollen spherical. Pistillode usually present. Fem. fl. with usually gamophyllous perianth sometimes accrescent and fleshy in fruit, ovary superior 1-celled, style simple or 0, stigma papillose, plumose or penicillate. Ovule 1, attached at or near the base, erect, orthotropous. Fruit a drupel or utricle, usually enclosed in and often united to the perianth. Seed with membranous testa and oily albumen. Embryo straight.

I. Hairs (at least those on inflorescence) stinging. Flowers cymose. Leaves alternate :—
  A. Female perianth 4-phyllous or deeply 4-lobed :—
    Herbs. Style or stigma ovate or linear finally hooked, sometimes appendaged at the base . . . . . 1. *Fleurya.*
    Suffruticose (in our species). Stigma linear, papillose on one side . . . . . 2. *Laportea.*
  B. Female perianth tubular 2-3 toothed . . . . . 3. *Girardinia.*

II. Hairs not stinging :—
  A. Flowers cymose 2-4-merous. Stigma penicillate :—
    Herbs. L. opposite. Fem. tepals distinct, unequal . 4. *Pilea.*
  B. Flowers clustered or very shortly cymose, clusters often spicate. Female perianth tubular :—
    1. Stigma filiform or linear. Fruit without a fleshy base :—
      a. Stigma not articulate, persistent :—
        Trees or shrubs. Flower-clusters spicate (in our spp.) 5. *Bochmeria.*
      b. Stigma articulate, deciduous. Herbs (in our spp.) :—
        Stigma filiform. Fl.-clusters axillary. Fl. 4-5-merous 6. *Pouzolzia.*
        Stigma linear. Fl.-clusters spicate. Fl. 2-3-merous 7. *Distemon.*

2. Stigma subpeltate, fimbriate. Fruiting perianth in a fleshy cupule :—
Trees or shrubs. Leaves alternate. Fl.-clusters axillary and from leaf scars . . . . . 8. *Villebrunea.*

1. FLEURYA, *Gaud.*

Nettle-like herbs with stinging hairs. Leaves alternate, toothed, 3-nerved with linear cystoliths. Stipules connate in opposite pairs or 0. Flowers monœcious or dicœcious, clustered, clusters in axillary sometimes spiciform cymes which are 1-sexual or androgynous. Male flower 4–5-merous. Fem. fl. perianth cupular 4-lobed or tepals 4 imbricate, equal or unequal, posticous hooded, anticous minute or 0. Ovary oblique with obliquely ovoid or linear finally hooked permanent style with sometimes 2 basal arms. Achene oblique, compressed, exserted, membranous. Seed nearly exalbuminous, cotyledons broad.

1. **F. interrupta,** *Gaud.* Lal-bichua, *H.* ; Bara-kanj, *Uran.*

An erect herb 2–3 ft. high puberulous and with stinging hairs but without bulbous bases on the stems. Leaves ovate acuminate 5–6″, coarsely dentate-serrate, glabrous beneath except on the nerves, above thinly hispid with bulbous-based hairs. Petioles longer than the blade. Inflorescence very long and lax, 8–14″, its branches and pedicels recurved. Male and female in the same clusters.

Usually near houses and ruins. Ranchi ! Khurda ! Fl., Fr. Sept.–Oct. Probably annual.

Leaves subcordate, truncate or cuneate at the base. Stipules 2-fid. Fem. fl. oblique on the pedicel. Perianth with unequal tepals, with few erect hairs at the base. Ovary oblique, very fragile. Style upcurved subulate with 2 shorter basal subulate arms which are sometimes absent. Ripe achene exserted compressed with 3 marginal ridges, the middle one sub-alate, faces corrugate.

2. LAPORTEA, *Gaud.*

Trees, shrubs or herbs with (sometimes very minute) stinging hairs and alternate, entire or toothed palmi-nerved or penni-nerved leaves ; stipules free or connate. Flowers mono- or dicœcious, in paniculate usually 1-sexual cymes or racemes, upper cymes usually very long and male, flowers and fruit often reflexed. Male : sepals 4–5, subvalvate, pistillode clavate or subglobose. Fem. : perianth segments 4, subequal or outer small, one sometimes absent, ovary at length oblique, style linear, papillose on one side. Achene oblique, compressed, membranous or fleshy, seated on the perianth, sometimes obliquely stipitate. Seed subexalbuminous, cotyledons broad.

1. **L. crenulata,** *Gaud.*

A soft-stemmed shrub 3–8 ft. high with white stout branches, large shining elliptic penninerved leaves and greenish flowers in divaricate cymes. Utricle inflated, white.

Deep shady ravines in the Karampoda forest, Singbhum ! Fl. Sept.–Oct. Fr. Nov.–Dec. Evergreen.

L. 12″ by 4·5″ or more, quite entire in our area, minutely pustular and with few scattered hairs. Inflorescence covered with hairs.

The sting of this nettle is most virulent, the effects sometimes lasting for days and producing sleeplessness and fever. It has been noted (*Hook, Him. Journ.*, and by others) that it is worst in the autumn, and indeed I have often found it

quite innocuous at some times of the year. This is due to the hairs being deciduous, and that they are especially abundant on the inflorescence. While cutting coupe-lines in November in the Sikkim Tarai, where it is sometimes gregarious, my coolies have been attacked with sneezing, violent catarrh and ultimately vertigo from, apparently, inhaling the numerous minute hairs.

3. GIRARDINIA, *Gaud.*

Herbs or undershrubs with stout stinging hairs. Leaves alternate palmately 3-nerved, often lobed, stipules intrapetiolar connate, foliaceous. Flowers dioecious or monoecious, clustered, clusters in simple or panicled spikes or heads armed with stinging hairs. Male: sepals 4–5-valvate, stamens inflexed in bud, pistillode globose or cupular. Fem.: perianth tubular, ventricose, 2–3-toothed, at length split on one side. Ovary straight, stigma subulate, papillose. Achene broad, compressed, seated on the perianth, pericarp rather thick. Seed subexalbuminous, cotyledons broad.

1. **G. zeylanica,** *Decaisne.* Syn. G. heterophylla, var. zeylanica, *F.B.I.*; Nettle.

A coarse herb 4–6 ft. high with numerous long slender stinging bristles. Leaves large lobed and coarsely dentate or serrate, 4–8″ long and broad, membranous, with numerous short fine bristles or hairs. Stipules ·3–·5″ long, 2-fid, membranous or somewhat green. Male flowers 4-merous mostly in short axillary spikes, hairy, filaments long persistent. Pistillode globose. Female fls. in dense capitate panicles with fleshy cymose branches and very bristly with stinging hairs. Perianth sometimes with a short free tepal on the split side. Fruit coriaceous, ·15″ diam., flattened, obliquely ovate, persistent style deflexed.

Not at all common. Ranchi district, 2000 ft. and above, Pitorea, *Wood*! Ichadar! Fl., Fr. Oct.–Nov. Dies back in the c.s.

4. PILEA, *Lindl.*

Herbs, rarely undershrubs. Leaves opposite, often unequal in the pairs, palmately 3-nerved (subnerved in *P. microphylla*), stipules intrapetiolar. Flowers minute, monoecious or dioecious, in axillary pedunclcd dichotomously branched cymes with bracts small or 0. Male: sepals 2–4, free or connate in a cup, often gibbous or horned at the back, pistillode conic or oblong. Fem.: tepals 3, rarely 4, very small and unequal, dorsal longest, sometimes gibbous or hooded, staminodes minute, of scales or 0. Ovary straight, stigma sessile penicillate. Achene ovoid or oblong, compressed, embraced by the base of the tepals or not. Seed erect, albumen very scanty, cotyledons broad.

Erect herb with narrowly elliptic leaves 3–6″ long . . .	1, *scripta.*
Prostrate herb with very small leaves ·1–·2″	2. *microphylla.*
Similar with leaves up to ·5–·6″	var. *portulacoides.*

1. **P. scripta,** *Wedd.*

An erect branched glabrous herb with rather succulent stems, 1–3 ft. high. Leaves sometimes slightly unequal in the pairs or with unequal petioles, narrowly elliptic finely acuminate, 3–6″ long, closely acutely but shallowly serrate, lineolate both sides with minute cystoliths,

principal nerves 3 meeting in the apex, tertiaries (there are none that can be called secondaries) numerous fine transverse and reticulate. Petioles slender ·7–1·5″. Stipules acuminate ·1″, intrapetiolar but their bases connected also by a fine interpetiolar membrane. Male sepals not horned. Achenes (not seen in my specimen) minute bordered with a strong intermarginal ridge, strongly granulate.

Meghasani, Mayurbhanj, elev. 4000 ft.! Fl. r.s. Fr. Oct.

The extreme base of the leaves is usually minutely cordate or notched. Ours appears to be the southern limit of the species, but a closely allied one, *P. trinervia*, occurs in Madras.

2. **P. microphylla,** *Liebm.* Syn. P. muscosa, *Lindl.*; The Gunpowder Plant (from the cloud of pollen when shaken).

A prostrate or sometimes suberect small rather succulent herb with numerous patent branches and distichous very small leaves for the most part unequal in each pair, elliptic oblong or obovate, entire, penninerved but nervation very obscure. Petiole very short. Cymes very small, from nearly every axil, usually sessile, androgynous or 1-sexual. Male tepals mucronate. Median tepal of the fruiting flower hooded.

Very common in plant-houses and verandahs, but also naturalised in the damper districts on walls, etc. Native of South America.

A form with very small leaves and a very distinct-looking larger-leaved form are common. *De Candolle* distinguishes the following varieties:—

α. The type with very small leaves 1·5–5 mm. long. Diffuse. Common.

β. hernarioides. Stems sometimes short and erect, filiform, little branched, leaves obovate or rotund spathulate 5–10 mm. long, often attenuate into a slender petiole.

γ. portulacoides. Stems prostrate with divaricate branches, leaves obovate 10–15 mm. long, attenuate into a distinct petiole. This is, I think, our larger leaved form.

δ. longifolia.

5. BOEHMERIA, *Jacq.*

Shrubs or small trees with opposite and alternate toothed palmately 3-nerved leaves. Stipules usually free. Flowers in 1-sexual clusters which are arranged in axillary or panicled spikes or racemes, or clusters axillary. Male perianth 3–5-lobed or -partite. Stamens 3–5, pistillode clavate or globose. Fem. perianth tubular, 2–4-toothed, fruiting sometimes angled, winged or swollen. Stigma filiform, persistent. Achene closely invested by the perianth, crustaceous, at length free. Seed albuminous. Cotyledons ovate.

The genus has usually very strong bast fibres. *Boehmeria nivea*, the China Grass, which yields Rhea or Ramie fibre, with beautifully white under-surface to the leaves, is sometimes grown in gardens and has been cultivated in Shahabad, Bhagulpur and Purneah, but more widely in the adjacent northern Bengal districts. It requires a moist warm climate and Purneah would be the most suitable of the northern districts in our area, but probably Cuttack or Puri would be even more suitable, though, I believe, it has not been tried there. The leaves are alternate, ovate, acuminate, dentate. Clusters in axillary paired laxly cymose panicles, the female panicles in the upper axils.

Clusters all spicate in our indigenous species:—

Tree. Leaves alternate elliptic, 3–6″ . . . . . 1. *rugulosa.*

Shrubs. Leaves mostly opposite:—

Leaves linear-lanceolate to lanceolate, 6–15″, opposite . . 2. *macrophylla.*

Leaves elliptic to ovate, 4–8″, mostly opposite . . . . 3. *platyphylla.*

1. B. rugulosa, *Wedd.* Dar, *Nep.*

A small tree with dark rough bark and narrowly elliptic or elliptic-lanceolate leaves 3·5–7″ long, acute or somewhat acuminate, closely crenulate, pale beneath with a fine hoary tomentum. Dicœcious. M. spikes 2–3·5″ long, slender flexuous when mature, pubescent, the clusters each supported by a broadly ovate bract ·1″ long. Fem. spikes similar, sometimes only ·75–1″ and stiffly spreading in flower, 3–6″ in fruit, perianth hispid-hairy. Achenes elliptic, stipitate.

Sameshwar Hills, on the boundary of Nepal, 2900 ft.! Fl. Sept. Fr. Nov.

Our tree is small and stunted, but I have seen it in Bhotan 40–50 ft. high and 4–5 ft. girth. Blaze pink. Upper surface of leaf glabrous, often rugulose, closely dotted when dry, primary nerves strong, others weak. Petiole ·7-1·3″, Stipules ·15″. The clusters are contiguous in young flowers and are covered by the bracts in bud and resemble catkins; they become distant in maturity and the spikes more flexuous.

2. B. macrophylla, *Don.*

A large shrub 6–10 ft. high easily recognised by its long opposite narrowly lanceolate rugulose serrulate leaves 6–15″ long, and long drooping axillary spikes with very close clusters of flowers. Monœcious.

Saranda forests in ravines, rare! Fl. Sept.–Oct. Fr. Feb.

Twigs terete or somewhat angled, strigose. Leaves 1–3″ broad, strongly 3-nerved, tapering from the obtuse base, rather pale and strigillose on the nerves beneath, the nervules raised and forming areoles beneath, depressed above. Petiole ·75–3″ (in the very long leaves). Stipules free, ·6″, caducous. Spikes axillary drooping, 6–8″ or nearly as long as the leaves, rhachis and receptacle hirsute, clusters globose, ·25″ diam., contiguous in fruit. Fruiting perianth clavate or pyriform, compressed, suddenly constricted at the minute 2–4-toothed mouth, thinly hairy, ·07″ long, persistent style hooked in fruit.

3. B. platyphylla, *Don.*

A spreading loose shrub 4–10 ft. high with branches strigose or strigillose especially at the nodes, and large broadly elliptic or ell.-ovate leaves 4–8″ long by 3–6″ broad, opposite or rarely upper sub-alternate, usually unequal in each pair and with unequal petioles 1–6″ long, margin crenate-dentate or coarsely serrate, base rounded to cordate, often oblique. Flowers monœcious (or rarely dicœcious ?). Males in usually branched spikes from the lower axils, females minute in close clusters under ·2″ diam., on simple short or very long spikes from the upper axils, sometimes spikes male below and female above. Fruiting perianth narrowly ellipsoid or slightly obovoid, ·03″ long, somewhat or scarcely compressed, sometimes unequally angled.

In moist or shady localities, or in ravines in the hills. N. Champaran! Purneah! Singbhum, Palamau, Ranchi, Hazaribagh, either in ravines or on banks at 2500 ft. and upwards! Similar localities in the Southern Area. Angul! Puri! Sambalpur! Fl. r.s. and c.s. Fr. c.s. and h.s. Evergreen.

A variable plant split up by some botanists into a number of species but connected by many gradations. The female spikes have to be compared in similar stages as they are erect and shorter than the leaves when young, often the same being long inclined or drooping with age. I follow *Weddell* in treating the forms as varieties of one species, especially as it seems that the var. *scabrella* (*B. scabrella, Gaud.*) has been variously interpreted.

Don describes his type (*Urtica platyphylla, Ham., M.S.*) as with leaves cordate-ovate acuminate, coarsely serrate and with the branchlets very scabrid both sides, female spikes simple with the clusters distinct, male spikes compound. It was collected in Nepal.

Weddell (*Monograph*, 1856-57), who apparently includes the type under his form

α, describes this form as with leaves broadly ovate, gradually acuminate with rotund or cordate base and whole margin (even the tip) serrate or crenate-serrate, sparsely hispid above, hispidulous beneath, spikes simple or (esp. the male) simply branched, female equalling or exceeding the leaves, erecto-patent with the clusters pisiform distinct. He quotes *Wall.*, No. 4582 (*a*) from Nepal and this agrees very well with the common B. & O. plant usually placed under *scabrella*. Chota Nagpur! Angul!

Var. scabrella, *Wedd.*

Leaves smaller than in the type, rounded at the base, suddenly shortly caudate, hispid, lower spikes shorter, upper exceeding the leaves, all erect. *Weddell* quotes *Wall.*, No. 4581 (*Goyalpara*), in which the upper spikes are only up to 5·5″. I doubt whether this is the *B. scabrella* either of *Cooke* or *Prain*.* It is not the Parasnath plant called *scabrella* by *Clarke*, which appears to me to be only a harsh-leaved state of form *α* of *Weddell*.

A Purneah plant with soft rhomboid-elliptic leaves 3–5″, not or very shortly acuminate, acutely dentate, not markedly rugosely-areolate below (as in the Parasnath plant) and with erect spikes scarcely longer than the petiole seems to come near to this.

6. POUZOLZIA, *Gaud.*

Herbs, more rarely shrubs, with alternate or opposite 3-nerved usually entire leaves, uppermost sometimes passing into bracts. Stipules usually free. Flowers in 1-sexual or androgynous clusters in the axils of the leaves, clusters never spicate except by the reduction of the leaves at the ends of the branches. Male perianth 4–5-, very rarely 3-partite or -lobed, tepals often dorsally gibbous or abruptly inflexed, pistillode clavate or oblong. Fem. perianth tubular with contracted 2–4-toothed mouth, fruiting often angled or winged, stigma filiform articulate on the ovary and deciduous. Achene closely invested by the perianth, usually free within it, crustaceous. Seed with albumen very scanty or 0. Cotyledons ovate.

A. Tepals of male convex or gibbous dorsally, so that the buds are rounded:—
  Primary nerves 3. Petioles ·1–1″. St. 4 or rarely 5 . . . 1. *indica*.
  Primary nerves 3–5. Petioles 1–4″. St. 5 . . . . . 2. *auriculata*.
B. Tepals of male abruptly inflexed about the middle and angled at the flexure so that the buds are truncate:—
  Stem with leaves becoming bractiform above so that the flowers become spicate . . . . . 3. *pentandra*.
  Stem not running out into a bracteate spike . . . . 4. *hirta*.

1. P. indica, *Gaud.*

A herb with creeping rootstock and 2–4 ft. long weak stems more or less scabridly hairy. Leaves ovate to ovate-lanceolate or lanceolate, ·5–1·3″, entire, dotted and appressed hairy beneath, less so and shining above, base rounded, midrib with 1–2 sec. n. only. Petiole ·1–·2″ (attaining 1″ in outside specimens). Flowers axillary about 6 in a cluster. Male buds globose and apiculate, very strigose, stamens 5 (–4), tepals convex, oblong, acuminate. Fem. somewhat oblong, fruiting with 4 larger and 2 smaller wings above showing as ridges below. Stigma feathery ·17″ long.

Singbhum, near streams, not common! Ranchi, *Clarke*! Chota Nagpur (without locality), *Wood*! Sikkim Tarai (and probably Purneah), *Kurz*! There are no

* *Clarke* (in *Journ. Linn. Soc.*, xv, p. 124), when he wrote that *B. scabrella* was quite distinct from *B. platyphylla*, was dealing with a plant he found on a journey from Darjeeling to Tonglu in British Sikkim!

specimens in the *Cal. Herb.* from our area except a fragment from *Wood* and the Tarai one. Fl., Fr. Oct.–Jan.

The Singbhum plant has all the leaves alternate and is probably var. *tetraptera*, *Wedd.* Some varieties have the fruit ridged but not winged and the leaves mostly opposite. In one of *Clarke's* specimens the achenes are ovoid 8-ribbed, 2 lateral each side sometimes larger. Leaves reduced in size upwards but not bractiform as in *pentandra*.

2. **P. auriculata,** *Wight.*

Shrubby with erect branched stem, branches virgate, wrinkled (when dry) puberulous or hairy. Leaves alternate, lanceolate elliptic or ovate, acute or gradually acuminate, hispid-puberulous or asperulous above, more or less pubescent or pilose (pubescent-tomentose, *Weddell*) beneath, margins ciliate, 1–4″ long, 3–5-nerved and with a pair of opposite sec. n. about half way up. Petioles long, at least at base, 1–3″. Clusters axillary, androgynous, male 5-androus. Fruiting perianth apterous and ribbed or auricled or subalate, 1·5–3 mm. broad, apex 2-dentate.

Singbhum, *Clarke*! On syenite hills. Rare. Fl. Nov.

L. when young canescent, base acute or obtuse and sometimes rounded.

3. **P. pentandra,** *Benn.*

Herbaceous or sometimes suffruticose at the base, usually decumbent below, then erect or trailing up to 3 ft. long or more. Leaves linear tapering to linear-lanceolate, or lower ovate or ovate-lanceolate, always opposite below, 1·5–3″ long, upper and floral bracts gradually smaller and alternate, sec. n. 0. Petioles short, or 0 in the upper leaves. Flowers very inconspicuous in nearly all the leaf axils, the clusters becoming spicate above from the gradually decreasing size of the leaves. Males 5-merous pedicelled cup-shaped below, the upper part of the tepals membranous and abruptly inflexed in bud so that the cup has a truncate or depressed top and a prominent angle or plait at the flexure. Fem. sessile, most minute in flower, conspicuous in fruit, perianth at first smooth tubular 2-toothed, subsequently tube ridged on one side and the two tepals becoming alate, finally fruiting perianth with a large white concave cordate or emarginate combined wing ·1–·12″ long, and a fleshy ridge, enclosing black shining conical achene which is as long as the fleshy ridge.

River banks and wet places. More common than the others. Singbhum! Ranchi ascending to Neterhat 3000 ft.! Palamau! Sambalpur! Fl. Aug.–Oct. Fr. Oct.–Dec.

Stems from a perennial rootstock bearing buds in the autumn, often red, usually with raised puberulous lines decurrent from the leaf bases. Leaves dotted, margin and sometimes the 3 nerves ciliolate. Base rounded or cordate. Stipules very small.

4. **P. hirta,** *Hassk.*

Slender with hairy or nearly glabrescent stems. Leaves, larger 4·5″ by 1·1″, lanceolate with rounded base, hairy, hispid or glabrescent, old copiously marked with small white dots above, usually strongly 3-nerved a little above the base, the three primary nerves extending nearly to the apex, 1–2 weaker nerves on each side below the primary. M. flowers globose truncate, hairy above, with long pedicels ·1–·15″, 5-merous, in close clusters.

Parasnath, 3000 ft., *Clarke*, *Campbell*, etc.! Fl. Oct. Also Sikkim Tarai! Leaves on young plants ovate and 1·6″ long only, on mature plants up to 5″ acuminate, base sometimes sub-cordate. Petioles ·05–·15″ only, hairy. Fruit apterous or 2-3-alate.

7. DISTEMON, *Wedd.*

Herb with alternate, toothed, 3-nerved leaves and minute monœcious flowers clustered in the axils of bracts in axillary and terminal androgynous spikes. Male perianth tubular below with 2–3-fid valvate limb. Fem. perianth ovoid-tubular 2-toothed, closely investing the compressed ovoid ovary. Stigma linear, deciduous. Achene broadly ovoid, acuminate, included in the thickened perianth, pericarp fragile.

1. D. indicum, *Wedd.*

An erect slender herb 2–3 ft. high, scarcely branched, puberulous or sparsely hairy. Leaves 2·5–4·5″ ovate caudate, coarsely dentate, hairy beneath on the nerves and thinly cobwebby between, hairy above, base shortly cuneate, sec. n. 1–more to each of the 3 principal nerves. Petiole slender 1·2–1·5″ long. Stipules ·4″ lanceolate with a long setaceous tip. Spikes erect 1·2–5″ long, sometimes leafy at the base, bracts sub-amplexicaul ovate cordate with cuspidate tips. M. and F. in same axils, about 1 mm. long only. Stamens 2–3 exserted. Achene ·1″ long, ovoid, beaked.

Ranchi, elev. 3000 ft. under shade in rocky places! Fl., Fr. Aug.-Sept. Dist. Assam, Burmah, and Java.

8. VILLEBRUNEA, *Gaud.*

Trees or large shrubs with alternate 3–5-palmi-nerved or penni-nerved leaves. Flowers monœcious or diœcious clustered, clusters axillary or from leaf scars sometimes in short lateral cymes or panicles. Bracts minute. Male perianth 4–5-fid with a pistillode. Fem. perianth ovoid narrowed to a minute mouth, somewhat fleshy in fruit. Ovary adnate to the perianth, stigma capitate fimbriate. Fruit consisting of a crustaceous achene free or adnate to the perianth, the base of which is sunk in a fleshy cup which grows up round it (and is said to consist of connate bracteoles).

The achene is described as adnate to the perianth in the *F.B.I.*, but it seems to me to be merely closely invested by it in our species.

1. V. frutescens, *Blume.*

A large straggling shrub with hairy twigs. Leaves ovate acuminate or caudate membranous, 3–7″ long, dento-serrate except at the rounded or very obtuse base, hispidly hairy above, more softly hairy beneath, sec. n. several and tertiaries very reticulate. Petiole long, often half to three-fourths as long as blade. Stipules subulate awned ·4″. Flowers male in dense subsessile or sessile female in cymose clusters axillary and from old leaf scars, conspicuous in fruit from the fleshy white cupules from which the ripe perianth and enclosed achene fall. Achene somewhat compressed, minutely pitted.

Near streams. Mals of Puri! Mayurbhanj, elev. 4000 ft.! Fl., Fr. April-May. The leaves are very variable in this species and I have only described the form in our area. The Mayurbhanj plant has them more hairy and pale beneath, not so large and with petioles only ·5-1·3″, but they are not full-grown.

FAM. 125. MORACEÆ.

Trees or shrubs, rarely herbs, nearly always with milky latex. Leaves alternate, very rarely opposite, simple, rarely deeply cut, frequently dotted (due to cystoliths). Stipules deciduous, often sheathing and leaving a permanent annular scar after falling (resembling that of many Magnoliaceæ). Flowers small or minute, green or colourless, dicœcious or monœcious, cymose but cymes often dense and becoming capitate, or sometimes spiciform, in some genera crowded on the outside or inside of fleshy receptacles formed of the growth and union of the floral axes; male and female inflorescence sometimes different. Tepals usually 4, seldom 2, 3, 5 or 6, valvate or imbricate, free or connate. Stamens isomerous or reduced in number, when isomerous then opposite the tepals, inflexed or erect in bud, anthers with longitudinal dehiscence. Female perianth often accrescent in fruit. Ovary superior, 2-carpellary, 1-celled. Styles 2 or 1–2-partite, or simple (anterior branch only developed), papillose on the inner side, rarely stigma terminal peltate or tubular. Ovule pendulous from top, amphitropous with micropyle superior, seldom basal and orthotropous. Fruit an achene, or drupe, or sub 2-valvular, often aggregated into large fleshy pseudocarps. Seed albuminous or not. Embryo mostly curved, cotyledons often very unequal, thick flat or one folding round the other.

I. Stamens inflexed in bud with reversed anthers. Flowers not usually crowded on or inside large fleshy receptacles, recepts sometimes globose and fleshy in fruit. Perianth usually fleshy in fruit:—
  A. Fem. fl. solitary or 2-3 on a peduncle, style 2-fid. M. fl. capitate or subcapitate:—
    Spinous shrub. Fem. tepals foliaceous, up to 1″ in frt. — 1. *Phyllochlamys.*
    Unarmed shrub or tree. Fem. tepals small enclosing the ovary, fleshy in fruit . . . . . — 2. *Streblus.*
  B. M. and Fem. fls. spicate or fem. in ovoid heads. Perianth fleshy in fruit. Style 2-fid . . . . . — 3. *Morus.*
  C. Fem. fl. in globose heads, sometimes forming a fleshy pseudocarp in fruit. Style simple:—
    M. fl. spicate. Achenes fleshy, long-stipitate on the globose receptacle in fruit . . . . . — 4. *Broussonetia.*
    M. and fem. fls. in globose heads. Achenes few, large, sunk in the fleshy pseudocarp in fruit . . . . — 5. *Plecospermum.*

II. Stamens straight in bud. Flowers crowded in globose heads or on or inside fleshy receptacles:—
  A. Fls. in dense globose heads. Achenes many on the fleshy globose receptacle. Male 4-androus . . . . — 6. *Cudrania.*
  B. Fls. crowded on the outside of oblong or irregularly globose large receptacles. Male monandrous . . — 7. *Artocarpus.*
  C. Flowers crowded on the inside of fleshy receptacles, of which the mouth is closed by bracts . . . . — 8. *Ficus.*

1. PHYLLOCHLAMYS, *Bureau.*

Thorny trees or shrubs with milky juice. Leaves penninerved. Flowers dicœcious, males in short axillary bracteate spikes or heads;

female solitary, peduncled. Tepals 3–4 ovate imbricate in the male, lanceolate accrescent and foliaceous in the female. Pistillode dilated at top. Ovary straight in flower, finally very oblique with the 2-partite style lateral. Fruit included in the perianth, obliquely globose or ovoid, pericarp sub-fleshy below, very thin above and finally 2-valved. Seed oblique, testa thin, albumen very scanty. Embryo very large fleshy globose, one cotyledon larger 2-fid enclosing the smaller, radicle upcurved.

1. **P. spinosa,** *Bur.* Syn. Trophis spinosa, *Roxb.*; Jhumpuri, *Or.*; Putkuli (Mayurbhanj).

A small tree or shrub with the branchlets often terminating in a sharp thorn, sometimes with a line of pubescence on one side. Leaves rhomboidly elliptic or somewhat obovate acuminate, coarsely irregularly toothed towards the apex, 2–4″ long, glabrous, not dotted, base minutely cordate on the petiole, sec. n. 8–10 with many weaker intermediate looped or united into an intramarginal one. Petiole ·1″ puberulous or pubescent. Stipules lanceolate about as long. Male heads ovoid ·15″ long, sessile; involucral bracts many imbricate with strong mid-rib and sometimes mucronate. Female sometimes two together with bracts at the base of the short pedicel, fruiting tepals erect and conniving over the fruit, lanceolate acuminate from a cordate base, attaining 1″ long. Fruit splitting into 2 valves when quite ripe, obovoid ·4″ with short style and two very long stigmas persistent on one side.

Ranchi, very rare, ravines on the ghats near Bishanpur! Cuttack! Puri, fairly frequent! Angul, in ravines, rare! Fl., Fr. April–June. Evergreen.

2. STREBLUS, *Lour.*

Trees or shrubs, the juice sometimes only slightly milky. Leaves scabrid penninerved or sub-3-nerved at the base, stipules small, subulate. Flowers di-, rarely mon-œcious, males in peduncled heads axillary and from the leaf scars, females solitary or 2–4 together axillary, peduncled, bracteate at base. Male tepals 4 connate at base, imbricate, stamens isomerous, pistillode dilated at the top. Fem. tepals free imbricate, embracing the ovary. Ovary straight with central long deeply 2-fid style with very long arms. Ovule pendulous. Fruit with a membranous or thinly coriaceous pericarp enclosed in the fleshy perianth. Seed globose, testa membranous, albumen 0. Embryo globose, one cotyledon very large fleshy, enclosing the small one, radicle upcurved.

1. **S. asper,** *Lour.* Kakasa (rough), Ote, Ripi chum, Hara-saijang, Sukri-saijang, *K.*; So : or, *Ho.*; Sahra, *S.*; Sihora, *Th.*; Sara, *Or.*; Sora, *H.*

A rigid much-branched shrub or small tree (where not browsed down) with stiff very scabrid rhombic-elliptic or obovate leaves 2–4″, very shortly petioled. Male heads ·25–·3″ diam. on 1–3-nate peduncles nearly as long, or up to ·5″, bracts very small ovate under ·05″ long, outer involucrate; flowers 6–8, perianth about ·1″ long, tepals connate below, one sometimes smaller than the others, stamens

exceeding the perianth. Fem. peduncles ·3–·4″ with 2–3 bracts ·07–·08″ long at the top supporting the flower, tepals free but closely wrapping round the ovary ·08–·1″. Fruit yellow succulent (including the succulent perianth), ·15″.

Throughout the province but chiefly in the moister districts. Very common in Purneah! Also very common in parts of Angul and Puri, less so in other districts and then near nalas! Fl. March-April. Fr. May-June. Evergreen. Renews leaves in March.

Bark tough, stringy, light grey; blaze with a thin chlorophyll layer, then white, followed by a gradual darkening and a slight exudation of small drops of latex. Leaves usually obscurely toothed, acuminate, scabrid both sides, sec. n. 7-9 of which 1 (each side) close to base and sub-primary, others irregular and looping, reticulate between with nervules raised beneath. Stipules ·1″. Style below bifurcation about ·07″, arms ·3″ long.

A favourite food of goats, which often prevent the tree developing otherwise than as a small, gnarled, intricately branched bush. The wood is very tough. *Gamble* gives the weight as 40-45 lbs. and states that the leaves are used for polishing ivory and wood.

3. MORUS, *L.* Mulberry.

Trees or shrubs with alternate entire toothed or 3-lobed palminerved leaves and caducous stipules. Flowers spicate, mon- or di-œcious, tepals 4–3 imbricate, those of the female fleshy and swollen in fruit, enclosing the achene and more or less confluent into a syncarp. Pistillode turbinate. Ovary straight with central 2-partite style. Ovule pendulous. Seed subglobose, albumen fleshy. Embryo incurved, cotyledons oblong equal, radicle ascending incumbent.

M. spikes lax, ·5-1·5″. F. spikes ovoid, styles connate high up . . 1. *indica*.
M. and F. spikes 1·5-5″ long linear dense. Styles bifurcate from near the base . . . . . 2. *lævigata*.

1. **M. indica,** *L.* Syn. M. alba, var. cuspidata, *Bureau* (the Purneah plant so named in the *Calcutta Herbarium*); Siah tut, *H.*; Tut, *Beng.*

A shrub or small tree up to 25 ft. high with ovate or broadly ovate, caudate, sharply serrate, often deeply lobed leaves 2–5″ long. Flowers with the young leaves. Male spikes rather lax-flowered broadly cylindric or ovoid ·5–1·5″ long, hairy all over, pedicels short, tepals elliptic ·08–·1″ long, stamens twice as long. Fem. spikes short-ovoid on slender peduncles about half as long, tepals obovate with white margins, styles long, connate below, hairy. Fruit ovoid or subglobose, red, then black.

Common in dry forests and stony places in the Terai and Duars to the east! and in the sub-Himalayan tract west of our area, no doubt therefore occurring within it. *Hamilton* says (in his account of Purneah) "both kinds of *Morus* are here very common." Also cultivated in Bihar, Tirhut and Chota Nagpur! Fl. Oct.-Feb. Fr. April-May. Deciduous for short period in January or February.

Bark light grey. Buds perulate. Leaves scaberulous, pubescent when very young, basal nerves 3 and 3-4 sec. n. on the central one. Petiole ·5-1·5″ Diœcious (where I have seen it). Male peduncles short slender.

Brandis says "a deciduous tree, for silkworms grown as a shrub," but in its truly wild state along stony sub-Himalayan nalas in Mixed Forest I have frequently seen it flowering as a shrub, as, in fact, he himself describes it in his old *Forest Flora*.

2. **M. lævigata,** *Wall.* Kimbu, *Nep.*

A large handsome tree, young shoots hairy or villous. Leaves ovate or broadly ovate, caudate, with base mostly cordate and often

oblique, serrulate (in wild examples), 3–7″ long. Flowers with the nearly developed leaves; both sexes in long dense narrow more or less pendulous spikes 3–5″ long, with very hairy rhachis, pair of tepals in the female facing the edges of the much compressed ovary usually somewhat keeled, inner flat; styles papillose, only connate at the extreme base. Fruit pale-yellow, very small, in long-cylindric syncarps.

Wild in the Sikkim Tarai close to our area, not wild within it. Said to be cultivated in Behar, near the Soane (*Brandis*).* Cultivated on the Ranchi plateau (differs in some respects, see below)! Fl. Feb.–March. Fr. April–May.

Bark light grey. Twigs lenticellate. Buds perulate. Leaves hairy when young, especially along the nerves, basal nerves 3 and 4-6 sec. n. along the central one, tertiaries distinct, scalariform. Petiole rather stout, 1″. Dioecious. Peduncles ·5″, hairy or villous. Male fl. sessile, tepals hairy. Fem. tepals glabrous (*teste Brandis*) or hairy (in my specimens).

The following form is cultivated in Ranchi :—

A large tree differing from the last in the more coarsely serrate leaves with rounded or subcordate base (often oblique) and especially in the shorter suberect female spikes which are only 1·5–2″ long and less hairy.

Var. **viridis,** *Bureau.* Syn. Morus viridis, *Ham.* (Wall. Cat. 4650.)

Leaves rounded at the top. Patna, *Hamilton*! No doubt only cultivated.

4. BROUSSONETIA, *Vent.*

Trees with alternate and sub-opposite hairy simple or deeply lobed serrate leaves and lateral deciduous stipules. Flowers dioecious, in solitary axillary capitate or cylindric dense spikes or heads, not connate. Males 4-fid or -lobed, valvate, pistillode minute. Fem. mixed with persistent bracts, perianth ovoid or tubular, 3–4-toothed enclosing the stipitate ovary, style subulate, entire. Ovule pendulous. Fruits (drupels) free on the globose receptacle, fleshy with a fleshy elongated stipes, but with a crustaceous rugose endocarp and excentric style, surrounded by the bracts and unaltered perianth. Albumen scanty or fleshy, cotyledons oblong, equal, radicle ascending, incumbent.

1. **B. papyrifera,** *Vent.* The Paper-mulberry.

A small quick-growing tree with the branches marked with stipular scars, subtomentose branchlets and large obliquely ovate or oblong simply serrate or also (especially when young) deeply palmately 3–5-lobed soft leaves 3–9″ long. Petiole 2–3″. Male flowers in cylindric pubescent pedunculed spikes 1–3″ long. Fem. flowers in tomentose globose heads ·3–·7″ diam., shortly stoutly peduncled, heads over 1″ in fruit, red, the individual fruits each with a fleshy red stipes.

Planted in the damper and warmer districts. Fl., Fr. r.s.

The Japanese make paper from the bark of this tree which also yields a textile fibre. It is easily grown both from seed and from cuttings or root division, but I have nowhere seen it planted in the Province except for ornament.

* *Hooker* quotes *Brandis* for the Bihar habitat, but there is a specimen of his own collecting at Kew marked "Soane River." Patna is also near the Soane (see var. *viridis*).

5. PLECOSPERMUM, *Trecul.*

Trees or shrubs with alt. entire penninerved leaves, small lateral stipules and dicœcious flowers in lateral 1–3-nate peduncled heads. Male perianth gamophyllous with 4 distinct imbricate lobes, pistillode minute hairy. Fem. flowers connate into a fleshy head with the almost closed very minute projecting mouth of perianth 4–2-toothed. Ovary straight, sunk deep in the head from which projects the long simple filiform style. Ovule pendulous. Achenes few in the fleshy pseudocarp, coriaceous, adnate to the perianth. Albumen 0. Embryo large subglobose with a very large cotyledon embracing a smaller folded one.

1. P. spinosum, *Trecul.* Banabanka, *Or.*

A large thorny shrub often climbing by means of its straight or slightly curved thorns, the lower of which attain 2–3″, the upper axillary ·5″. Leaves elliptic or obovate 2–3″ long, suddenly contracted to a short rounded tip, more rarely gradually acute, base acute, midrib strong, sec. n. about 6–8 but weak, arching and forming areoles, and when fresh appearing with the branching included nervules as green reticulations on a paler ground. Male heads tomentose ·2″ diam., flowers nearly sessile with minute bracteoles, perianth-lobes connate about half-way up ovate subobtuse. Fem. heads ·2–·25″ diam., angular from the small projecting flower apices from which the slender ·15–·2″ long flexuous styles protrude, velvety-tomentose, attaining ·3–·5″ in fruit.

Damp jungles. Cuttack! to Puri! Frequent. Fl., Fr. March–June. Evergreen.

Sometimes confused with *Cudrania javanensis* (*q.v.*). Branchlets often pubescent. L. with thickened margin. Petiole ·25–·35″ pubescent. Stipules minute subulate. Peduncles ·2–·7″, pubescent, from the axils of bracts on abbreviated shoots or below the leaves or axillary. Achenes ·2″.

6. CUDRANIA, *Trecul.*

Trees or shrubs with alternate entire penninerved leaves, small lateral stipules and dicœcious flowers in lateral 1–3-nate peduncled globose heads. Male flowers each surrounded by 2–4 bracts more or less adherent to the perianth, tepals 3–5, imbricate, stamens more or less adnate to the tepals, erect in bud, pistillode subulate or 0. Fem. flowers distinct, tepals embracing the ovary. Ovary straight, style simple or 2-partite or with one arm rudimentary. Ovule pendulous. Achenes numerous enclosed in the fleshy pseudocarp formed of the accrescent bracts and perianth, crustaceous, compressed. Testa membranous, albumen scanty; cotyledons twisted and folded, equal or unequal, embracing the slender upcurved radicle.

1. C. javanensis, *Trecul.*

A large scandent shrub in habit and foliage much resembling *Plecospermum spinosa*, branchlets often densely hairy or pubescent, armed with strong axillary straight or somewhat curved thorns ·5–1″ long. Leaves elliptic or somewhat obovate 1–3·3″ mostly shortly obtusely acuminate or rounded but always mucronate with the

excurrent midrib, base acute or subobtuse; sec. n. 6–8 fine but distinct, looping and including fine intermediate nerves and much reticulate nervules, margin slightly thickened. Petiole ·3–·5″ Flowers heads greenish or yellow mostly geminate in the axils, ·25–·3″ diam. Pedicels short tomentose ·1–·25″. Males pubescent, often compressed with (usually 5) large oblong rounded tepals with inflexed tips, pistillode slender. Female head ·3″ diam. in flower, 1″ in fruit, globose.

Near rivers or streams. N. Champaran! Purneah! Fl., Fr. April-May. Evergreen.

The Orissa locality (in *Bengal Plants*) appears to be an error founded on a wrongly named sheet of *Plecospermum* in the *Cal. Herb.* The following differences easily serve to discriminate the two species in the field even without flowers. The areoles formed by the sec. n. in *Plecospermum* are occupied by much branched nervules with *free* endings whereas the nervules are mostly truly and closely reticulate in the *Cudrania*, the leaf tip is usually different (see above), the male tepals are much more conspicuous in *Cudrania*, while the female heads are quite different, being quite globose (not angular) in *Cudrania* with the individual flowers easily separable; the ovary is sunk between the perianth lobes but is not relatively so deep in the head. The achenes are numerous all round the circumference of the larger pseudocarp.

7. ARTOCARPUS, *Forst.*

Trees with alternate coriaceous, often very large, leaves entire or pinnately lobed, or pinnatifid when young and entire when mature, penninerved. Stipules usually leaving an annular scar. Flowers monœcious, densely crowded on globose or variously shaped 1-sexual, usually axillary solitary receptacles, often mixed with peltate bracts. Male perianth 2–4-lobed or -partite, lobes concave, valvate or slightly imbricate, stamen 1 erect in bud, pistillode 0. Fem. perianth tubular, confluent below with the receptacle, mouth minute, ovary straight, style central or lateral, stigma entire rarely 2–3-fid; ovule pendulous. Fruit a large fleshy syncarp covered superficially with the fleshy perianths and the usually apically spinous or otherwise hardened carpels, the lower parts of which are deeply sunk in the syncarp. Seed often very large, exalbuminous, embryo straight or incurved, cotyledons fleshy equal or unequal, radicle very short, superior.

A. Leaves of mature trees undivided. Native or commonly cultivated species:—
  1. Syncarp not tubercled (tips of anthocarps flat):—
     Branchlets and leaves softly pubescent or tomentose . . 1. *lakoocha*.
  2. Syncarp tubercled:—
     Syncarp globose, 3–4″ diam. Leaves obovate, scabrid . 2. *chaplasha*.
     Syncarp not globose, 12–30″ long. L. smooth shining . 3. *integrifolia*.
B. Leaves of mature trees pinnatifid. Exotic, rarely cult. . . 4. *incisa*.

1. **A. lakoocha,** *Roxb.* Daho, Dahu, *H.*, *K.*, *S.*; Denyo, Barhal, Barhar, *H.*; Madar, *Beng.*; Jeota, *Or.* (Lakucha is the Sanskrit name).

A moderate-sized tree with broad dense crown, villosely-tomentose branchlets, large elliptic or ovate, obtuse or shortly acuminate leaves 6–10″ long, pubescent or tomentose beneath, entire. Recepts. axillary, males subsessile from previous year's, females short-peduncled from current year's axils. Male recept orange-yellow, spongy, ovoid, ·75–1″, closely covered with the minute peltate bracts, perianths and

scarcely exserted stamens, deciduous. Fem. recept. irregularly sub-globose, 3–4″ diam. and yellow when ripe with the surface nearly smooth.

Wild in the Champaran forests! also in the Saranda forests of Singbhum! Manbhum, *Camp.*! Ranchi (Damuda ghats)! Hazaribagh (Parasnath)! and in the Mals of Puri! possibly wild also in Purneah! Frequent in villages throughout the area! Wild but rare in the Orissa States, *Cooper*. Fl. Dec. and April. Fr. May and Oct.–Nov. Sub-deciduous March.

Bark grey, flaky in small scales, blaze red, immediately followed by drops of white latex. Leaves with 8–13 strong sec. n. nearly reaching the margin, tertiaries numerous, raised beneath, scalariform and closely reticulate, pubescent. Young leaves sometimes serrate (*F.B.I.*). Petiole ·5–1″. Stipules ·5″, lanceolate villous, caducous but leaving a considerable scar.

The timber is not of much value in our province, as the trunk does not attain any great height as it does in more humid forests. *Gamble* states that it is highly prized in the Andamans and gives the wt. as 40 lbs. The young male recepts as well as the fruit are eaten. *Hamilton* states that the basket makers stain bamboo by equal parts of the bark of this tree and of the "Dangtrangga" beaten together with a little lime and water.

2. **A. chaplasha,** *Roxb.* Latar, *Nep.*

A magnificent, tall, straight tree occurring in the forests of the Darjeeling district just north of our boundary, but probably not now within it. The leaves of young trees are 1–2 ft. long, elliptic lanceolate and irregularly pinnatifid with a large terminal lobe, of mature trees broad obovate 8–12″ with prominent nerves. Bark smooth light coloured, slightly transversely marked from the stipular scars, old slightly cracked. Stipules 1·5″ sheathing. Fruits 3–4″ diam., globose, tubercled with the flattish hispidulous tips of the anthocarps.

Fr. June.

3. **A. integrifolia,** *L. f.* Kathal, *H.*; Kanthar, *K.*, *S.*; Panus, *Or.* Jack Fruit (the name Jack said to be derived from the Indian names jaca or tsjaka, *vide De Candolle, Origin of Cultivated Plants.* I can find no record of such a name for this tree in India. The Sanscrit name is Panasa).

A well-known tree with very dense rounded crown, coriaceous elliptic entire (or in young plants sometimes lobed) leaves 4–8″ long, of a dark shining green above. Petiole ·5–1″. Stipules glabrous long sheathing and leaving an annular scar after falling. Male recept cylindric 2–6″ without bracteoles to the flowers, tepals 2. Fruiting recepts attaining enormous size, 12–30″, tubercled.

Everywhere cultivated, but succeeds best in the moister districts. Native of the Western Ghats. Fl. Dec.–Feb. Fr. r s.

The recepts are lateral on the trunks and branches, but on special branchlets. The inflorescence is at first enclosed in 2 very large leathery yellowish bract-like stipules belonging to the leaf (often small) on the special branchlet in whose axil the first recept arises together with another lateral bud, the main axis is slightly displaced by the developing recept and the next very reduced internode bears again a pair of large stipules and a younger recept and sometimes a bud; this arrangement is continued and the buds develop according to the luxuriance of the branchlet, on which the small leaves may remain or not; the bud arises alternately to the right and the left of the developing recept.

The wood of the Jack is excellent and is largely used for the large drums (dumung) of the Kols and Santals. The fruit sometimes weighs up to 80 lbs. and is said to be demulcent, nutritious and laxative. It is rather difficult to digest and, in large quantities, produces diarrhœa. The seed is roasted and eaten. The tree readily germinates from seed, which is large (over 1″ long) and ellipsoid. The seedling requires shade.

4. A. incisa, *L. f.* The Bread-fruit Tree.

Only occasionally cultivated as a curiosity in the Cuttack district. It is a native of the Pacific Islands and requires a hot moist climate without cold in winter.

8. FICUS, *L.* Fig.

Trees or shrubs always with milky juice, often epiphytic when young, sometimes scandent. Leaves usually coriaceous or harsh, very rarely opposite, entire, more rarely toothed or lobed; stipules sheathing the bud and leaving a circular scar after falling. Flowers minute, often mixed with bracteoles, 1-sexual, on the inner surface of a fleshy receptacle the walls of which leave a very narrow mouth which is more or less completely closed by small imbricating bracts. Recepts androgynous with the fewer males nearest to the mouth or sometimes 1-sexual. Unfertile female flowers (gall flowers) occupied by the larva or pupa of a hymenopterous insect (belonging to the fam. Chalcididæ) are present in the androgynous or functionally male recepts. Male perianth 2–6-fid or -partite, segments imbricate, stamens 1–2, rarely 3–6, erect in bud. Fem. fl. with perianth similar to the male, or reduced, ovary straight or oblique, style excentric, ovule pendulous. Fruit an achene or fleshy, small, included in the accrescent fleshy syncarp (fig). Albumen scanty, embryo curved, cotyledons equal or unequal.

The pollination of the female flowers is possibly effected by the small insects above alluded to, which escape through the mouth of the receptacle and in so doing brush against the male flowers which are sometimes only in a zone close to the mouth. Where, however (as occurs in some species), males and galls occupy one set of recepts and females and neuters another set, it is not evident how this pollination takes place, as the entry of the insect into the female receptacle would presumably be followed by puncture of the ovaries. It is stated, however, that the short ovipositor of the insect can only reach the ovule of the short-styled stigmaless gall-flower, but not the long-styled and papillose female flower.

It is to be noted that *Cunningham* (*Ann. Cal. Gard. I*, Appendix) from his researches on *Ficus Roxburghii* throws doubt on the whole theory. He does not consider that pollination is necessary for the development of the embryo in figs and does not believe that the gall insects are able to pollinate.

In the following key a stipes means a slender basal prolongation of the receptacle itself and is distinguished from a pedicel. The whorl of 3 bracts usually found at the base of the receptacle is situated at the apex of the pedicel, or, if the fig is sessile, at the base of the receptacle or its stipes (if it has one); sometimes scattered bracts are found on the receptacle.

I. M., Fem. and Gall fls. in the same receptacle. St. 1. Trees (or epiphytes becoming trees). Leaves never hispid. Recepts never hispid, always axillary (or from the axils of fallen leaves) and paired or, if clustered (nos. 8 and 8*a*) under ·5″ diam., not stipitate (exc. 6) nor on special branches (Nos. 1–14):—

A. Leaves glabrous (Nos. 1–12):—

1. Lateral nerves, sec. n. and almost as strong intermediate, close (exc. in 4), fine and parallel, recepts always paired:—

a. Leaves orbicular or broadly elliptic:—

L. 2–3·5″, lateral basal nerves spreading parallel to the sec. n., petiole slender, ·5–1″. Recepts yellow, ·6–·9″ . . . . . 1. *comosa*.

L. 2–3″, lateral basal nerves oblique. Petiole ·3–·5″. Recepts purple or white, ·4–·5″ . . 2. *retusa*.

b. Leaves elliptic or oblong:—
i. Recepts sessile:—
L. tapering both ends, 2-5″. Sec. n. 6-10. Recepts ·25-·35″ . . . . . 2. *retusa* var. *nitida*.
L. ell. or oblong, 6-12″, sec. n. very close. Recepts ·5″ . . . . . 3. *elastica*.
ii. Recepts pedicelled:—
L. oblong, 5-10″, glossy, sec. n. rather distant 7-10 . . . . . 4. *glaberrima*.
L. 2·5-5·5″, base rounded or obtuse, sec. n. 10-14 . . . . . 5. *glabella*.
2. Lateral nerves not close and parallel, intermediate not resembling the secondary (see also No. 4):—
a. Leaves elliptic or oblong (or some ovate in 7), abruptly acuminate:—
i. Recepts always geminate:—
L. 5-10″, sec. n. 7-11. Recepts stipitate . 6. *nervosa*.
L. mostly under 6″, sec. n. 5-10. Recepts sessile 7. *infectoria*.
L. of *infectoria*. Recepts pedicelled, often pubescent . . . . . var. *Lambertiana*.
ii. Recepts mostly clustered, small, bracts broad, often 2-fid:—
L. not highly polished, 5-8″, nervation of 7 . 8. *geniculata*.
L. highly polished, beautifully venose, 5-8″ . *tjakela* (p. 832).
b. Leaves ovate (also elliptic in 9), often with dots beneath (raised when dry):—
i. Leaves obtuse or with short blunt acumen and long petiole:—
L. 3·5-5·5″, sec. n. 6-12. Recepts with broad base, not wrinkled when dry . . . 9. *tsiela*.
ii. Leaves acuminate or caudate:—
L. 4-6″, gradually acuminate, rarely caudate, rarely cordate, not finely reticulate. Recepts ·6-·75″, wrinkled when dry, with broad sessile base . . . . . 10. *Rumphii*.
L. 4-7″, abruptly caudate, cusp ·5-1″, base cordate, finely reticulate. Recepts depressed-globose, ·4-·5″, subsessile . . . . 11. *Arnottiana*.
L. 5-7″, caudate with cusp, 1-2″ long. Recept black, sessile, ·4-·6″ . . . . . 12. *religiosa*.
B. Leaves tomentose or pubescent beneath, at least when young. Recepts usually pubescent, sessile. Aërial roots usually present:—
Midrib not glandular. Recepts scarlet puberulous, ·5-·7″ . . . . . 13. *bengalensis*.
Midrib with an elongated gland at base. Recepts tomentose, ·25-·5″ . . . . . 14. *tomentosa*.
II. M. and Gall. fls. in separate recepts to the Fem. St. 1-3. Trees, shrubs or climbers. L. often hispid or scabrous. Recepts usually hispid, 1, 2 or more together, axillary or in clusters or on special leafless branches, often large, sometimes bracteate, often stipitate:—
A. M. fl. with 1 stamen and large pistillode or gall fl. Recepts paired or fascicled, stipitate, hispid:—
Tree. L. elliptic or ovate acute. Recepts ·25-·3″ . 15. *cuspidifera*.
Large epiphyte. L. broadly rhomboid obtuse, hispid 16. *parasitica*.
B. M. fl. without a pistillode or ovary:—
1. Stamen 1:—
a. Leaves alternate:—
i. Recepts not on special leafless branches:—
Climbing shrub. Recepts 1-2 axillary . . (22) *scandens*.
Weak shrub. L. heteromorphous. Recepts solitary, hispid . . . . . 17. *heterophylla*.
Small tree. Recepts paired, hispid . . 18. *asperrima*.
ii. Recepts on special, often subradical branches:—
Small tree with semi-sagittate leaves . . 19. *cunia*.

b. Leaves opposite. Recepts mostly on special branches:—
Small tree. Branches hispid. L. ovate-oblong or obovate . . . . . 20. *hispida*.
Low spreading shrub in river beds. Branchlets hirsute. L. lanceolate or oblanceolate . . 21. *sæmocarpa*.
2. Stamens 2-3. Leaves alternate:—
a. Climbing shrub. Recepts 1–2 axillary, pedicelled . . . . . 22. *scandens*.
b. Recepts very large (1–2″ diam.) on tubercles or special short branches:—
i. Erect shrub or branches prostrate . . . 23. *lanceolata*.
ii. Small trees:—
L. ovate to elliptic, 4–7·5″ . . . . 24. *glomerata*.
L. very broad, 8–18″ long by 5–12″ broad . 25. *macrophylla*.

1. **F. comosa,** *Roxb.* Syn. F. Benjamina, var. comosa, *Kurz* (there is some doubt, however, whether F. Benjamina, *L.* is not synonymous with F. retusa, var. nitida. There is no doubt as to *Roxburgh's* plant. Hence I have taken the name given by him). Pokaha, *S.*; Paniar, Lakhar, *Th.*

A very handsome, large quite glabrous tree with slender drooping branches, broadly-elliptic or -ovate abruptly acuminate or shortly caudate, with rounded or very obtuse base scarcely 3-nerved, the two lateral basal nerves being hardly stronger than the very numerous close spreading secondaries and spreading more or less parallel to these; secondaries about 12 with their scarcely finer intermediaries all meeting in an intramarginal nerve close to the thickened margin. Recepts mostly terminating or towards the ends of the branchlets geminate axillary (but the leaf often suppressed or deciduous), sessile quite globose or suddenly contracted into the base, ·6–·85″ diam., one basal bract not sunk in the base (cp. *retusa*), two others almost concealed by the base and often inconspicuous and concolorous with recept.

Champaran, forests of Ramnagar and Bettiah! Santal Parg., in valleys! Valleys in Singbhum and Hazaribagh! Manbhum, *Cal. Herb.*! Angul! Nayagarh! Recepts ripen March–May. Evergreen.

Our plant appears to be *F. Benjamina* var. *comosa*, *Kurz*, from its large fruit, that of *Benjamina* being described with fruit only ·3″ (which is the size of the fruit of *retusa*!). On the other hand in var. *comosa* the sepals of all the flowers are said to be "lanceolate-acuminate not spathulate." This is quite different from our specimens in which the *bracts* are lanceolate, but the tepals are very obtuse sub-spathulate and outermost hooded; the anther is globose, apiculate.

The tree is easily recognised in the forest by its habit and finely nearly horizontally striate nervation of leaves which are 2 by 1″ to 3·5 by 2″ or sometimes broader in proportion. Petiole slender ·5–1″, grooved. Stipules ·4–·5″, linear-oblong acuminate. Recepts up to ·9″ in length when contracted at base, bright yellow when ripe (sometimes white?).

2. **F. retusa,** *L.* Syn. F. benjamina, *Willd.* (Sp. Plant. Ficus No. 42?). Buti-hesa, Chuman-hesa, *K.*; Jili, *S.*; Jir, *Beng.*

A small or large tree, epiphytic when young on trees or rocks with rather small rotund, obovate, oblanceolate or elliptic leaves always with a cuneate 3-nerved base, lateral basal nerves not or not much stronger than the secondaries but *oblique*, secondaries 6–10 with many nearly as strong intermediate, all meeting in an intramarginal nerve close to the thickened margin. Recepts in axillary pairs sessile

divaricate subglobose ·3–·4″ rarely ·5″ diam. when ripe, succulent white or purple.

Champaran! Chota Nagpur, frequent! Gaya ghats! Santal Parg.! Orissa States, *Cooper*! Kalahandi! Ripe recepts have been found Oct.–Nov. and March–May, but there may be two species included here, viz. :—

Var. **retusa** proper, *F.B.I.*

Leaves 2 by 1″ to 3 by 2·5″, orbicular to broadly elliptic, rounded obtuse or obtusely acuminate at the apex. Petiole ·3–·5″, sometimes thinly pubescent. Stipules lanceolate acuminate, ·4–·5″, sometimes pubescent. Recepts ·4–·5″, thinly hairy within. Tepals free, oblong or oblanceolate rounded. Ovary long, stipitate above the tepals.

Chota Nagpur to Kalahandi!

Smooth bark on youngest twigs, cracking and falling off leaving them rough. Sometimes closely resembling *F. comosa* but habit different.

Var. **nitida,** *F.B.I.* Syn. F. nitida, *Thunb.*

Leaves lanceolate oblanceolate or narrowly elliptic, tapering both ends, 2″ by ·8″ to 5″ by 2·5″. Petiole ·3–·4″ and stipules always (?) glabrous. Recepts ·25–·35″, sometimes slightly warted. The rest much as in *retusa*. Anther broadly oblong, longer than the filament.

Champaran! Santal Parganas! Fr. March.

3. **F. elastica,** *Roxb.* The Indiarubber Tree.

Epiphytic (but often grown from cuttings and then erect) with large coriaceous oblong or elliptic shining leaves 6–12″ long with numerous and very close spreading fine sec. n. and glabrous leaf-scales and stipules 6–8″ long (just before unfolding of the new leaf). Recepts sessile, paired at leaf scars, "covered at first by hooded involucres which fall off and leave a basal involucral entire edged cup, when ripe ovate-oblong smooth greenish yellow about ·5″ long" (*F.B.I.*) or ovoid and greenish-yellow.

Indigenous in the Lower Himalaya not far from our area, but not within it. Frequently cultivated for ornament but of very different appearance from the large indigenous trees, which often start life some 50 ft. above the ground, from which height the aërial roots run down the trunk of the host to the ground and gradually enclose it.

The leaves on fruiting branches are often much smaller than the normal and the leaf-scales and stipules of unhealthy trees often fall off when only 3–4″ long. The hooded involucral bracts which are connate and circumscissile above the base are peculiar but not unique; the cup left after the fall is sometimes toothed.

This is the source of the true "india-rubber" which is chiefly obtained by tapping the large aërial roots.

4. **F. glaberrima,** *Blume.*

A small tree (tall in the Himalaya) with rather scanty latex. Leaves oblong glossy chartaceous 5–10″ long, shortly acuminate, with rounded or cuneate 3-nerved base, translucent-dotted when fresh; sec. n. rather distant, 7–10, spreading, raised beneath, looping not far from margin, reticulate between. Petiole ·5–1·5″. Recepts ·25″ diam. globose, pedicelled, orange-coloured when ripe, sometimes verrucose when young, basal bracts 3 caducous.

Along streams in the Sameshwar Hills! Fr. Jan.–March.

Bark tough and stringy, pale on the branchlets which and the young leaves beneath are said to be puberulous (*King*. They are glabrous in my specimens). Stipules glabrous ·5–·75″. "Male sepals 4, lanceolate, subsessile. Gall fl. sessile or shortly stoutly pedicelled, perianth 4-cleft. Fem. fl. when ripe with viscid achenes and no perianth," *F.B.I.* The bracts at the base of the recept appear to

be hooded over the receptacle when very young but only show as scars at the expanded top of the pedicels in the later stages. Base of receptacle rarely shortly stipitate above this expanded top of pedicel and in some Sikkim specimens hairy.

5. **F. glabella,** *Blume.* Putkul, *K.*

A small or mod.-sized tree with oblong or ovate-oblong suddenly acuminate or caudate not very shining leaves 2·5–3·5″ or sometimes up to 5·5″ by 2″, base rounded or obtuse, sec. n. 10–14 spreading, as strong as the two short lateral basal nerves, very closely and beautifully reticulate between and between the fine loops of the secondaries and the cartilaginous margin, reticulations raised both sides when dry. Petiole ·3–·75″ glabrous. Receipts globose or somewhat pyriform pedicelled ·25–·4″ diam., depressed globose, slightly or prominently umbonate (ostiole often however perforate like other figs after escape of the fig wasps), white, pink or blue, often verrucose, usually many, paired from the old leaf axils, some also from current leaf-axils. Basal bracts (at top of pedicel) not sunk in the base, membranous, broadly ovate, or triangular, sometimes deciduous.

Rocky ravines in the mountains. Singbhum! Ranchi and Palamau, Neterhat, 3000 ft.! Receipts ripen April–June. Top of Mailagiri Hill, Bonai, *Cooper*!

Cooper's specimen was from a very bushy tree of about 3 ft. girth, with very nodose branchlets, small leaves 1·5–2·5″ only and pisiform receipts with caducous bracts. All our specimens have pedicelled receipts and are apparently var. *affinis*. *F.B.I.* *Blume* describes his *glabella* as with receipts sessile. The pedicels are ·1–·2″ only and slender.

Aërial roots have not been observed. Buds sometimes puberulous. Stipules ·1–·3″.

6. **F. nervosa,** *Roth.*

A straight, sometimes large tree, with mouse-coloured tomentose twigs and buds. Leaves sometimes sub-opposite, oblong or oblanceolate, shortly suddenly acuminate or cuspidate, very dark above and shining both sides, attaining 10″ by 4″ but mostly 5–9″, with rounded or cuneate 3-nerved base, the lateral basal nerves very short and not stronger than the secondaries; sec. n. 7–11 depressed in the lamina when fresh so that the leaf appears bullate, looping not far from the margin, closely reticulate between. Petiole ·3–1″. Receipts subglobose ·3–·5″ diam. (·25–1″, *King*), purple when ripe, on slender stipes thickened upwards, bracts at base of stipes (none at base of receipt.) usually 2–3 connate.

Chiefly along nalas. Singbhum! Santal Parganas! Angul! Puri! Nowhere common. Receipts ripen March–May. Evergreen, renews leaves March.

Attains 8 ft. girth near Lapangi (Angul). Bark smooth, blaze pale brown, then white, hard. Stipules ·5″, densely or thinly hairy. Leaves glabrous except some fine hairs along the midrib. Pedicels ·3–·5″. "Male sepals 2 long, spathulate. Gall. fl. with 3, elongate, acuminate sepals. Fem. fl. with 3 lanceolate sepals. Achene ovoid acuminate." *King.*

7. **F. infectoria,** *Roxb.* Baswesa, Barsa-hesa, Pepe-hesa, Jojo-hesa, *K.*; Pakare, *S.*; Pakar, *H.*, *Beng*; Kua-jari, *Or.*

A m.s. or large tree, epiphytic when young, with glabrous, oblong or oblong-ovate, less often ovate, rather abruptly shortly acuminate leaves 3″ by 1·2″ to 7″ by 3·5″, usually thinner in texture than preceding,

margin often waved, base cuneate, straight rounded or slightly retuse, lateral basal nerves like the secondaries or more oblique, sec. n. variable in number 5–10, looping within the margin, nervules finely reticulate. Recepts sessile or stalked, glabrous pubescent or tomentose, ·25–·3″ or sometimes ·5–·7″ sub-globose but without the broad base of *Rumphii* and *tsiela*, whitish or flushed with red, basal bracts free ovate or orbicular spreading, ·07″.

A common fig. Champaran to Purneah! Sant. Par.! All districts of Chota Nagpur, wild and planted! Puri! Orissa States, common, *Cooper*. No doubt in all districts of the province. Recepts Dec.–June.

A very variable tree. Bark pale. Buds usually pubescent. Leaves often distinctly pellucid-punctulate, very rarely points raised into small tubercles when dry as in *Rumphii* and *tsiela*, not nearly so closely nerved as in *glabella* and always with much longer petioles than that species. Base seldom subcordate. Sec. n. usually pale and conspicuous above when fresh with evident intramarginal loops. Petioles 1·5–3·5″ slender. Stipules under 1″ caducous. Tepals 3 or often 4 or 5 linear or lanceolate, filament and anther short and broad.

The following varieties occur in our area :

(*α*) **infectoria** proper. Glabrous with recepts sessile.

Roxburgh says that "the bark is brownish ash-colour. L. oblong-cordate, waved, glabrous, 4–6″, with few veins. Stipules about 2″ long, slender, grooved, with a coloured gland round their apices (I think *petioles* are meant). Fruit sessile, white, size of a pea." This form is *rare*.

(*β*) var. **Lambertiana,** *King*. Syn. F. Lambertiana, *Miq*.

Pubescent on the pedicels and often recepts. Recepts pedicelled.

It is described in the *F.B.I.* as having "coriaceous leaves, base broad rounded emarginate or subcordate, receptacles ·3–·5″ diam., pedicel pubescent ·2–·3″." Under it I include the following forms : —

a. Buds puberulous. L. 3–4″, oblong to ovate, not at all cordate, sec. n. 5–8. Recepts ·4–·5″ (in Jan.), glabrous except the base and the stout pedicel. Singbhum!

b. Branchlets and buds pubescent. L. 4–7″, base not at all cordate, sec. n. 6–12. Recepts ·6–·7″ (March), base, bracts and ·4″ pedicel pubescent, and one specimen collected near a stream in Horhap forest with *apical* bracts also pubescent.

Chota Nagpur : Singbhum and Ranchi!

c. Buds silky, slender shoots soon glabrescent. L. much as in last. Recepts *densely tomentose* all over, ·6–·7″ diam., often subsessile, bracts rounded, entire or one 2-fid. Recepts with the gall insects escaping in March. Ranchi!

Lac sometimes grows on *F. infectoria* and the Kols say that the fruit is very good to eat.

8. F. geniculata, *Kurz.*

A large tree with grey very lenticellate twigs, large oblong or ovate-oblong shortly suddenly acuminate leaves 5–7″ long, not at all punctulate, margin sometimes undulate, base obtuse or rounded with 2 lateral basal nerves and sometimes 2 accessory weak ones added, sec. n. 8–12 translucent spreading looped some distance from margin, other intermediate often conspicuous and nervules very finely reticulate forming minute areoles whitish beneath, nervules slightly raised above. Petioles slender 2–3″ often thickened at junction with midrib. Recepts axillary paired and crowding the branchlets and also clustered on raised tubercles at the old leaf scars, subsessile or sessile, ·25–·3″, depressed-globose, verrucose ; basal bracts 3 broad, mostly 2-fid or lobed, with scarious or brown margins.

Wild in the forests of Singbhum (there used to be a tree on the hill in the Tholokabad forest on which the forest rest-house has been erected!) Frequent about Ranchi! Recepts. unripe ones seen in Sept., flowering ones with dead galls and not quite nature male-flowers in March. Old leaves shed in February, and the tree is then nearly leafless.

Buds and shoots silky, pubescent or tomentose especially at the nodes, the buds on bursting throw off a number of very long leaf-scales (as well as stipular coverings) 2–4″ long by ·3–·5″ broad, narrowly oblong and translucent and the young leaves are very membranous. Male flower with an oblique or split mouthed gamophyllous perianth and very broad anther. Female irregularly toothed or split. Receptacle with numerous filamentous scales among the flowers.

F. tjakela, *Burm.* Syn. *F. venosa, Ait.* is recorded in *Hamilton's* M.S. with the vernacular name of *Nata Pakur*, from Purneah. The true *F. tjakela* is a handsome tree with coriaceous oblong-ovate oval or oblong shortly abruptly acuminate leaves 3–7·5″ long with broad rounded or sub-truncate or cordate base beautifully venose and polished when dry. The small recepts only ·2″ diam. are clustered on nodose tubercles mostly at the scars of fallen leaves. It is a tree of the Deccan and probably *F. geniculata* or a form of *F. infectoria* was the tree referred to.

9. F. tsiela, *Roxb.*

A low or large spreading tree, often epiphytic, without aërial roots, or " sometimes sending down aërial roots like a Banyan," *C. G. Rogers.* Leaves coriaceous elliptic, or oblong- or narrowly ovate, more rarely ovate, 3·5–5·5″, distinguished from those of *F. Rumphii* by the very short bluntly acuminate apex or entire absence of acumination, the apex being merely acute or obtuse, also by the larger number of sec. n., 6–12 each side above the basal ones, and not much stronger than the intermediate, basal nerves usually 3 and 2 weaker ones. Recepts globose or globose-pyriform from a broad base, ·4–·5″ diam., not wrinkled when dry, 1–2 axillary and from leaf-scars, sometimes purple in all stages of development, in other specimens white, often with large but not raised dots.

Frequent in the Central Provinces and likely to occur in Sambalpur and Kalahandi, but the only tree I have met with in Bihar and Orissa was one at Partab, in the south of Puri district! Fr. Jan.–Feb.

Bark smooth, white or greenish, blaze with a thin chlorophyll layer, then pink or red or banded pink and white. When the leaves are ovate they much resemble those of *F. Rumphii*. L. minutely punctulate (as in *F. Rumphii*), dots translucent when fresh, showing as minute tubercles when dry, base rounded, cuneate or oblique, sec. n. less conspicuous than in *F. Rumphii*. Petiole usually half to nearly as long as the blade, often appearing articulate to blade. Innovations and recepts sometimes puberulous or pubescent. Basal bracts very broadly ovate, more or less connate, small and only covering the broad base of recept, unequal, largest ·05–·11″.

As in other cases the perianth appears variable, male tepals broadly obovate to oblong-lanceolate, gall stalked broadly elliptic or lanceolate with hyaline margins, female broadly ovate or ovate-lanceolate, sessile.

King shows both M. and F. tepals as lanceolate and acute in *tsiela*, oblanceolate and obtuse in *Rumphii*. *Roxburgh* points out that the stipular scars are not durable in this species. The tree alluded to by *Rogers* might be *Rumphii*.

10. F. Rumphii, *Blume.* Duranga-hesa, *K.*

A large or m.s. usually very spreading tree with glabrous or hairy twigs, ovate or broadly ovate leaves 4–6″ gradually tapering to the finely acuminate tip and with straight or obtuse or sometimes widely subcordate base (and then again shortly cuneate or obtuse on the petiole) with 3–5-basal nerves and 5–6 sec. n. looping within the cartilaginous margin. Recepts oblong-obovoid or globose with very

broad sessile base, glabrous or puberulous, wrinkled when dry, ·6–·75″ diam., black when ripe, basal bracts m.s. or large, extending one-fifth to one-half diam. of recept, glabrous, pubescent or silky, orbicular, almost hidden by large base of recept.

N. Champaran! Frequent along nalas in the hills of Singbhum, Hazaribagh and other districts of Chota Nagpur! Often in village lands and planted along roadsides where it does well, and is frequently called *Pipal*, than which it is usually a smaller, more spreading and less handsome tree. There appear to be two seasons for ripening the recepts, one in the r.s., the other Dec.-Jan. Evergreen (or some, esp. fruiting branches deciduous), renews leaves March–April.

Bark grey, not pitted as in the *Pipal*. Leaves conspicuously but minutely punctulate, margin often wavy, tertiary nerves meeting at an angle with those from the next secondary nerve or connected by nervules. Petioles 2-3″, usually one-third to three-fourths as long as the blade, much stouter and stiffer than in the *Pipal*. Stipules ·75–2″ glabrous. Recepts often crowded along the branches, geminate, both axillary and from the leaf scars, young verrucose or slightly so.

Blume's description is rather too brief to be sure of this being his tree, but he quotes an excellent description and figure of *Rumphius* which leaves no doubt about it. *King* would appear to have seen only glabrous specimens. The tree is seldom epiphytic and I have seen it in the form of slender poles in the forest when quite young.

Lac sometimes grows upon it. Said to be a good fodder and the fruit is eaten.

11. **F. Arnottiana,** *Miq.* Duranga-hesa, *K.*; Sunum-jo, *S.* Sometimes also confused with *Pipal*.

A glabrous small tree, or sometimes a shrub, with broadly ovate leaves abruptly acuminate or cuspidate and with a cordate base, usually about 6″ by 4–4·5″, sometimes 7″, the cusp only ·5–·8″, base with 3 strong and 2–4 much weaker nerves and 5–8 strong translucent straw-coloured (when fresh) sec. nerves looped within the cartilaginous margin, tertiaries and nervules very beautifully and closely reticulate (much more so than in *F. Rumphii*), final nervules sunk in the lamina enclosing very small pale areoles. Petiole often nearly as long as the blade, slender. Recepts mostly from the leaf scars depressed globose ·4–·5″ diam. subsessile or very shortly pedicelled, at first white and faintly reddish and verrucose, finally purple or nearly black. Bracts thickened pulvinate at base.

Epiphytic on trees or rocks, chiefly on dry rocks or in rocky places. Gaya ghats, frequent! Monghyr Hills, *Cal. Herb and Wall. Cat.* 4485 *c*! Karakpur Hills, *Kurz*! Singbhum, Hazaribagh and other districts of Chota Nagpur! Puri! Sambalpur! Ripe recepts found March-June and again (perhaps always var. *courtallensis*) Dec.-Jan. Deciduous about March or April, new leaves bright red, old often turn copper-coloured in Dec.

Stipules 1·3–2″ long, membranous, glabrous.

Var. *courtallensis* has ovate leaves mostly 3·5–4″ with base only slightly cordate or somewhat cuneate on the petiole. Recepts only ·28–·3″, when ripe verrucose, flushed red, pedicelled, slightly umbonate.

12. **F. religiosa,** *L.* Asvattha, *Sans*; Tepe-hesa, *K.*; Hesak', *S.*; Pipar, Pipal, *H.*; The Pipal Tree.

A very large tree, epiphytic when young, with rotund or broadly ovate, very long caudate, more or less pendulous leaves dark-green and shining above, 5–7″ long, the slender tail nearly one-third to half the entire length of the blade, base cordate, with 3 strong principal nerves and 2 or 4 weak ones, margin often waved, undersurface sometimes dotted when dry. Petiole slender, 3–4″. Recepts axillary

geminate, depressed-globose glabrous, black when ripe, ·4–·6″ diam., sessile.

In all districts, wild and cultivated, epiphytic on old masonry or on other trees. Fr. r.s. Nearly deciduous in the h.s. in the dryer districts.

Stems often very irregular, peculiarly pitted when old. All parts except bracts quite glabrous. Leaf 5–7-nerved at base, sec. n. 8–10 (excluding the fine acumen), looped within but very close to margin, acumen many-nerved rarely only one-fourth length of whole leaf; stipules 1·75–3″ long, linear subulate. Recept-bracts broad rounded, ciliate or pubescent, ·15–·23″ long, sometimes one 2-lobed, hooded over the very young recept which thus appears pubescent.

Branches much lopped for fodder and the fruit sometimes eaten.

Note.—*Wallich's* 4487 *H.B.C.* is partly *F. Rumphii* (on right of sheet) with unusually long acumen.

13. **F. bengalensis,** *L.* Ba : i, *Ho.*; Bare, *M.*, *S.*; Barh, Bargat, *H.*; Bor, *Beng.*; The Banyan Tree.

A large tree, epiphytic when young, sending down roots from the branches which form into accessory trunks. Leaves coriaceous, 4–8″ long or attaining 10″ by 7·5″ in robust specimens, ovate to elliptic with rounded or sub-cordate 3–5-nerved base, old glabrous or slightly pubescent beneath. Recepts sessile in pairs ·5–·75″ diam., subglobose scarlet when ripe, puberulous.

Throughout the whole province. Wild in the more humid forests, elsewhere often planted. Recepts may be found all the year round, but appear to ripen twice in the year, viz. April-June and Dec.–Feb. Nearly evergreen or quite so in favourable situations, renews leaves May–June.

Bark grey, blaze pale red, fibrous. New shoots pubescent. Leaves approximate near the ends of the branchlets, young softly pubescent and often reddish, sec. n. above basal 5–8, looping close to margin and united by numerous close tertiaries and reticulate nervules which are not raised. Petiole ·75–1·7″ long eglandular or mostly with a large, flat, smooth gland beneath near the confluence of the principle nerves. Stipules ·75–1″ long before falling (leaving a circular scar as in all other figs of our province). Recepts with 2–4, more or less connate, broad, obtuse bracts at the base.

Probably the best shade tree in the province. The timber is not of much value but is sometimes used for *sagar* wheels in Chota Nagpur and for well curbs. Birdlime is prepared from the latex. Useful for elephant fodder. The fruit is eaten in times of scarcity. The tree is easily propagated in the rains by inserting large cuttings (several inches in circumference). Seedlings grown by me were much attacked by a leaf fungus (*Septoria arcuata*),* which caused the fall of the young tender leaves and sometimes proves fatal.

14. **F. tomentosa,** *Roxb.* Janapa-hesa, *K.*; Chapakia-bare, *S.*; Barun, *Kharw.*

A large or small tree with tomentose or woolly branchlets and frequently with thin aërial roots. Leaves very variable in size, 2–8·5″, easily recognised by the more or less persistent tomentum and prominent venation beneath, by the cordate base and a curious longitudinal gland with depressed centre (when fresh) situated at the junction of the several principal nerves beneath. Recepts hirsutely white- or grey-tomentose ·25–·5″ diam. globose sessile.

Rarely epiphytic on trees but generally on dry rocks, often on the most arid hills, sometimes on old buildings, as on the Palamau Fort! Shahabad, Kymur Hills. Throughout Chota Nagpur! Santal Par.! Puri! Sambalpur! Recepts appear in the axils of the new leaves in June and remain over a year, the old ones being at the leaf scars. Evergreen, renews leaves in June.

* Kindly identified by *Miss Wakefield.*

The aërial roots of this species never develop into trunks. L. oblong, ovate or somewhat obovate, acute or obtuse, with a many-nerved base and 5-8 sec. n. above the basal. Petiole ·5-2″. Stipules ·9-1″ (in June). Recepts with 3 large orbicular tomentose basal bracts reaching half way up the recept, apical bracts (closing the mouth) minute, glabrous. Anther muticous (it is apiculate in *F. bengalensis*).

15. F. cuspidifera, *Miq.* Syn. F. gibbosa, var. cuspidifera, *F.B.I.*

Erect or climbing, epiphytic when young, with brown striate branchlets, elliptic or ovate acute or acuminate leaves 2–5″ by 1·25–2·5″, stiff, but neither pubescent nor very scabrid, base 3-nerved. Recepts 1–2 axillary, subglobose, ·3″ diam., minutely scabrid, umbonate contracted into a stipes ·2–·25″ long with 3 small connate bracts at its base with spreading ovate free portions.

Singbhum! Santal Parg.! Fr. Jan.

Buds narrowly lanceolate ·3-·4″. Leaf slightly scabrid on the nerves beneath and sometimes with scattered minute tubercles beneath, margin slightly thickened, base rounded or cuneate, lateral basal nerves extending about one-third length of leaf or less, sec. n. 4-6 strong looping with several intermediate and many reticulate rather prominent pale nervules. Petiole ·2-·4″. Tepals linear obtuse or spathulate, shortly closely pubescent or papillose, less so in female, bases attenuate and connate into a short stipes. Pistillode large and sometimes apparently exactly like the gall-ovary.

Both this and the next are united by *King* with *F. gibbosa*, *Blume*, probably correctly, but I have found it more convenient to describe the two varieties separately as species. Their general facies in the forest is different. *F. cuspidifera* is often erect with a trunk showing little or no signs of its having been epiphytic.

16. F. parasitica, *Koen.* Syn. F. gibbosa, var. parasitica, *F.B.I.*; Kaskasi jhari, *Or.*

A large epiphyte, with pale branches, rhomboid or subelliptic or ovate-rhomboid, usually oblique leaves up to 8″ by 4·5″, very hispid and somewhat shining above, pubescent and pale beneath, apex often rounded, base 3-nerved. Recepts mostly paired axillary and from leaf-scars, subglobose, ·2–·3″ diam., umbonate, pubescent hirsute or hispid, contracted into a stipes ·2–·3″ long with 3 small connate bracts at its base as in the last species.

Common on trees, often in the open. Ranchi plateau, common! Singbhum, mostly on the Porahat plateau! Gaya ghats! Hazaribagh (on rocks at Tatijharia)! Palamau, on the ghats! Angul! Fr. Feb.–April.

Buds narrowly lanceolate ·2-·25″. Leaf scabrid beneath and less pubescent between the nerves with age, margin thickened, base usually very oblique and obtuse, venation much as in the last species but with more conspicuous loops to the sec. n. and another prominent series of loops between these and the margin. Petiole pubescent ·3-·4″. Male fl. sessile with 5–6 linear acute (not at all spathulate) minutely papillose or puberulous tepals considerably exceeding the short stamen and pistillode or gall-ovary. Filament about equal to anther. In this species I have in several flowers found the male pistillode quite like that of the gall and occupied by an insect.

Probably only one variety, as *F. cuspidifera* is another, of *F. gibbosa*, *Blume*, a Javanese species. This form (*parasitica*) always appears to be epiphytic and even after the death of the host retains marked evidence of its previous habit. *F. gibbosa* is described by *Blume* with oblong to oblong-lanceolate or lanceolate leaves acuminate both ends and glabrous, scabrid on the margin, recepts pendulous.

17. F. heterophylla, *L. f.*

An infinitely variable shrub creeping, erect or sarmentose among bushes, twigs brown hairy hispid or with dense spreading pubescence,

leaves always more or less hispid or scabrid above, unlobed with cordate or oblique base or very deeply and variously lobed, margins always more or less toothed, receptacles always more or less pyriform and hispid when young, mature sometimes sub-globose ·5″ diam., mouth broad.

Always in wet or watery places. Purneah! Patna! Angul!
Recepts borne from Jan.–May, perhaps also at other times.

The following forms are found :—

α. scabrella (*F. scabrella Roxb.*). L. linear or linear-lanceolate 1·5-3″ not lobed, usually rough both sides, petioles ·1–·2″, stems 3–5 ft. high. Purneah!

β. heterophylla proper. L. 1-3″ usually ovate, shallowly or deeply pinnatifidly, 3–many lobed on the same plant, very scabrid at least above. Petioles mostly short but up to 1″ usually hispid. Stipules oblong-lanceolate ·15–·3″. Often creeping. Banks of Ganges, Bankipur! Banks of Mahanadi, Angul!

γ. repens (*F. repens, Willd.*). With usually slender erect branches, *not* creeping. Twigs hairy or hispid. L. elliptic to broadly ovate-oblong and unequal-sided 3–4″, in young plants under dense shade 4–6″ very membranous, above hispid or scabrid, beneath softly pubescent or glabrescent, sec. n. 5–6 of which one from base which is obtuse or deeply cordate, petiole often 2–3″ in young plants or only ·4–·6″ on some branches. Recepts axillary and from leafless axils solitary, young ellipsoid apex umbonate with a deep pit, older subglobose or pyriform, ripe ·75–1″ long. Peduncles ·2–·3″ or long and slender. Perianth of gall flower long, sepals 4 linear ·1–·12″ often alternate, pedical long. M. perianth lobes 3 shorter than in gall. St. 1.

The name *repens* for this variety is unfortunate.

δ. sarmentosa, Haines. Erect or scrambling up to 15 feet high and 8″ girth. Twigs with dense spreading pubescence. L. very scabrid 3–5″ oblong acute or acuminate with subcordate slightly unequal base, scabrellous beneath, shallowly serrate, sec. n. 6–7 one from base and a brown gland on the mid-rib at their origin. Petiole ·5–·6″ hispid. Stipules oblong-lanceolate caducous ·2″. N. Purneah!

18. F. asperrima, *Roxb.*

A small tree up to 30 ft. high, somewhat resembling *F. hispida*, but at once distinguishable by the alternate leaves. Twigs hispid. Leaves 3–6·6″ elliptic or ell.oblong acuminate, very scabrid above with minute discs and bristles, softly pubescent beneath, sec. n. 4–5 of which one from the base, tertiaries scalariform, strong beneath. Petiole ·6–1·5″, scabrid. Recepts paired ·6–·7″ or 1–1·25″ diam., globose, outside tomentose and with close bulbous-based hispid hairs, mouth with numerous erect yellow bracteoles, inner linear, outer broader.

Mals of Orissa! Recepts March–May.
A very distinct species. The leaves are described in the *F.B.I.* as 1-1·5″ only; these are probably young. Ripe recepts greenish-yellow, peduncle ·3″ with scattered small bracts, single axillary and from leaf-scars. M. fl. puberulous below, tepals 3-6 linear-oblanceolate, anther 1. Gall fl. tepals 6, similar. Pedicels and inside of recept villous.

19. F. cunia, *Ham.* Podho, ari, *M.*; A : i, *Ho.*; Hor-podo, *S.*; Kurur, *Th.*; Bhoka-dumbar, *Beng.*; Potkuli, *Or.*

A small or mod.-sized tree with elliptic or oblong-lanceolate, entire or serrate leaves easily recognised by the semi-sagittate base and very short petiole, basal auricle of leaf 3–4-nerved. Recepts in pairs or clusters on long (often several feet) mostly leafless drooping scaly branches often crowded near the root.

Common near streams and on cool, damp slopes of hills. Throughout the province! Fr. most of the year, usually ripe May-June. Evergreen or sometimes leafless in May.

L. 6-15″ long, acuminate, often scabrid above, more or less pubescent beneath, sec. n. 9-14. Petiole ·2-·6″. Stipules ·75-1″, linear-lanceolate puberulous. Recepts globose or pyriform, hispid, red-brown or quite white when ripe, sometimes half buried in the soil, pedicel very short, bracts 3 at top of pedicel. Style of gall fl. very short lateral, of female very long with 2-fid stigma.

Lac is often cultivated on its branches which is sold at 2 as. per seer in Singbhum or about one-quarter the price of Kusum lac. The ripe fruit is eaten.

20. **F. hispida,** *L. f.* Syn. F. oppositifolia, *Roxb.*; Kota Durga, *Th.* Kotang, *M.*; Sosokera, *K.*; Seta-podo, *S.*; Dumar, *Kharw.*; Poroh, *Mal P.*; Thedu, *Gond.*; Tambol, Balu-dumari, *Or.*

A small tree 10–30 ft. high. Branches hispid, internodes hollow. Leaves mostly opposite, ovate-oblong or somewhat obovate 4–9″, rather scabrid above and hispid beneath. Recepts numerous fascicled on both the trunk and branches, often on leafless drooping branches, also sometimes axillary, globose, closely shortly hairy, umbo prominent.

Along nalas, throughout the province! Common in the damper districts, not common in the dryer. Fr. Jan.–Feb.

Rarely 3 ft. girth, often fruiting as a shrub. Dwarf, slow-grown plants sometimes have the internodes nearly solid. L. toothed, rarely entire, cuspidate, base cordate or rounded mostly 5-nerved, sec. n. 5-7 strong and raised beneath looping close to the margin, tertiaries scalariform raised beneath and reticulate between. Petiole ·5-1·5″. Recepts 1″ diam., yellowish when ripe, base narrowed to a slender or very short stalk with scattered bracts, sometimes also a true pedicel very short with a subverticil of 3 bracts at its apex, hispid. Style hispid-hairy, stigma tubular. Male fl. very few.

Bark yields a fibre. The fruit is eaten.

21. **F. sæmocarpa,** *Miq.*

A low spreading or straggling bushy shrub 3–4 ft. high with hirsute branchlets. Leaves crowded 4–8″ opposite lanceolate or oblanceolate, acuminate both ends, base with 1 lateral nerve each side not stronger than the 8–10 secondaries which are upcurved close to the margin, nerves strigose or pubescent beneath. Petiole ·3–·8″. Recepts 1–2 from the axils of fallen leaves or on short leafless branches, globose with contracted stipiform base or ovoid or pyriform 1–1·3″ long excluding the ·5–·7″ stipes, hirsute, often 8–10-ribbed or verrucose, with scattered bracts on the stipes extending on to the body of the recept, apex with large-bracted umbo.

Rocky or stony beds and banks of rivers. Bettiah! Fr. practically all the year round.

This shrub somewhat resembles *F. lanceolata* and may be more common than is supposed in the province.

Leaves with lower surface minutely dotted with tubercles. Recepts "yellow-green and warted with yellow when ripe, the ridges terminating in a fleshy cornice," *J.D.H.* Branchlets bracteate. The top of the stipes usually with 3 deciduous bracts.

22. **F. scandens,** *Roxb.* Madhur lata, *S.*

A creeping and climbing shrub with the new shoots rusty and hispid. Leaves ovate or elliptic-ovate acute or obtuse 2″ by 1″ to 4″ by 2·75″, mature stiff and harsh, but scarcely scabrid above, glabrous or with sparse short hairs on nerves beneath, base obtuse or sub-

cordate or rounded 3-nerved, sec. n. 2–5 looping close to margin, intermediate 0 or very short, nervules very reticulate sunk and green when fresh, pale and rather obscure when dry. Petiole ·3–·75″. Recepts mostly solitary, axillary, hispid or hispidulous, globose ·3–·5″, or sometimes narrowed into a very short stipes above the ·3–·4″ long pedicel which is 3-bracteate at the apex.

Adhering to trees or rocks by rootlets. Sameshwar Hills! Valleys in Singbhum and on the Porahat plateau! Manbhum, *Campbell*! Parasnath, on the northern side! Sant. Par., rare! Mayurbhanj, 2500 ft.! Fr. Jan.–May.

The upper, especially the flowering branches are often spreading and may somewhat resemble young plants of *F. parasitica*, the fruit of which is also similar, but has a longer stipes and shorter pedicel. Indeed there seems considerable alliance between Section 1 *Palæomorhpe* of *King*, which is monandrous, and Sect. 6, *Eusyce*, described as 2-androus. *F. scandens* is 1-3-androus (I have found it 2-3-androus and *Roxburgh* draws it as 1-androus). M. and gall recepts in my specimens are larger (·4–·5″) than the female (·3″ diam.). M. perianth brown, short, irregular in shape, tepals free or nearly so, 4 (always?), anthers 2-3 large with very short filaments. Gall tepals 3-4 lanceolate or linear, glabrous, style subterminal. F. tepals 2-4 linear free. Achene oblong.

23. **F. lanceolata,** *Ham.* Gara-loa, *K.*; Gui, *Kisan*; Bambud, *Kharw.*

A glabrous shrub 3–5 ft. or even up to 10 ft. under shade, usually with prostrate stems or branches and resembling in many respects *F. sæmocarpa*. Leaves crowded above, alternate, lanceolate acuminate attaining 8″ by 2″, entire or distinctly toothed, dotted beneath. Recepts in dense clusters on woody branchlets near the root, red when young with yellow or pale warts, puberulous or glabrous, 1·5–2″ diam., top flattened or depressed.

In the rocky beds of streams. Singbhum, chiefly in the Saranda tract! Palamau, ascends to 3000 ft. at Neterhat! Sant. Parg.! Also noted by me from the Sameshwar Hills, Champaran, but without examination, and this may have been *F. sæmocarpa*. Fr. May–June.

Easily distinguished from *F. sæmocarpa* by the glabrous twigs and alternate leaves which are broadly linear or linear-lanceolate or lanceolate, but very rarely slightly oblanceolate, sec. n. 6-14 fine spreading short glabrous.

24. **F. glomerata,** *Roxb.* Loa, *K., S.*; Dumar, Gular, *H., Kharw.*; Dumbar, Jagidambar, *Beng.*; Dimri, Dumri, *Or.*

A mod.-sized or large tree with ovate, ovate-lanceolate or elliptic dark green leaves 4–7·5″ by 1·75–3·25″ narrowed to an obtuse or subacute tip and to an obtuse or rounded rarely acute 3-nerved base, paler beneath with microscopic green dots. Recepts 1–2″ diam. globose or pyriform pubescent on cauline and rameal branches which are usually short, or sometimes up to 2 ft. long; occasionally axillary recepts are also found.

A common fig. in valleys and on northern slopes, also frequent in villages. Throughout the province. Fr. March–June. Often more or less deciduous Oct.–Nov. Renews leaves Dec.–Jan.

Attains 10 ft. girth in Purneah, with buttressed trunk. Bark grey "rusty-greenish," *Roxb.*, usually marked with the annular stipular scars which (as in many other figs) grow in circumference with the trunk. L. usually glabrous above, often pubescent on the nerves beneath, sec. n. 4-7. Petiole ·75–1·75″. Stipules ovate-lanceolate, ·5–1″. Recepts red or reddish, with M., Fem. and Gall flowers in the same recept. M. near the mouth, tepals 3-4 inflated. Perianth of Gall and Fem. toothed. Achene granulate, stigma clavate.

The fruit is largely eaten.

25. **F. macrophylla,** *Roxb.* Syn. F. Roxburghii, *Wall.*; Kota, *M.*; Gara-sosokera, *Kol.*

A handsome low spreading tree with very large broadly ovate or elliptic-ovate cordate-based leaves 8″ by 5″ to 18″ by 12″, more or less repand-toothed or coarsely serrate (sometimes entire in cultivated plants) glabrescent above, shortly softly pubescent beneath. Petiole 1–4″ stout. Recepts pyriform, 2–2·5″ diam. on peduncles 2–3″ long clustered on cauline knobs and short lateral leafless branches.

Along streams. Above 1500 ft. in the Saranda Forests and on the Porahat plateau! Kochang, *Wood*, *Gamble*! Angul! Sambalpur, rare!

Dark brown. Branchlets hollow or with large pith, young pubescent. L. with 5–7-nerved base, sec. n. 5–7 high up on mid-rib and extending to margin where they enter the teeth, tertiaries mostly scalariform fine but prominent. Stipules 1″. Peduncles pubescent bracteate at their apex, base of recept produced into a stipes or not (the stipes is ·5″ long in some specimens). M. fl. tepals large inflated, stamens 2–3. Gall and fem. with 2-3-lobed perianth. Achene granulate, viscid, style long lateral curved, hairy, stigma tubular.

The fruit is eaten. Leaves said to be a good fodder.

FAM. 126. SALICACEÆ.

Trees or shrubs, nearly always dicœcious. Buds perulate. Leaves alternate simple, stipulate. Flowers in close bracteate spikes (catkins), one to each bract, ebracteolate. Perianth 0 or rudimentary; a median scale, scales or glands or a cupular or annular organ (disc or rudimentary perianth) present. Stamens 2 or more with free or connate filaments. Ovary of 2, rarely 3 connate carpels, 1-celled with parietal placentation. Ovules usually many, erect, anatropous on the lower part of the placenta. Fruit capsular, 2–4-valved. Seeds few or many, small, exalbuminous, with thin testa and a basilar pencil of hairs. Embryo straight, cotyledons plano-convex, radicle short inferior.

1. SALIX, *L.* Willow.

Leaves usually narrow. Disc or perianth of 1–2 separate glands or scales. Stamens usually few (up to 10 in our species, which is unusual). Bracts entire.

1. **S. tetrasperma,** *Roxb.* Nachal, *K.*; Gada-sigrie', *S.*; Chiur, *Kharw.*; Bes, *H.*

A tree or in one form a shrub, with silkily pubescent shoots, lanceolate or oblanceolate to ovate-lanceolate acuminate leaves sparsely hairy or glabrescent and pale glaucous beneath. Catkins terminating the short lateral shoots, 1·5–4″ long, pubescent. Disc glands very broad fleshy.

Along rivers and streams, apparently in all districts, but nowhere very common. Champaran, attaining 6 ft. girth in Ramnagar! Purneah! Monghyr! Santal Par.! All districts of Chota Nagpur! Athmalik (Orissa)!

Fl. Oct. usually, sometimes however in Feb. or May and fruits ripen soon after. It is leafless shortly before flowering and flowers at the ends of the new lateral shoots.

There are two distinct forms in our province (see below) agreeing in the large glands, male-glands anterior nearly as long as the ovate to obovate or spathulate,

·06″ pilose bract and often as broad, sometimes faintly crenate, posterior gland smaller 2-lobed, 2 small lateral side-lobes have also been noted by me in some specimens! Female gland 1, semicircular, and recognisable in fruit. Stamens ·15″ long, 5–10, often 7, pilose at base. Capsules ·17–·2″ long on slender stipes half as long to nearly as long as themselves. Stigmas 2, entire or 2-lobed.

Var. *α.* **tetrasperma** proper ?

A small tree or shrub with broadly lanceolate or oblong-lanceolate leaves crenate-serrate with rounded base, thinly silky beneath, sec. n. 12–15 fine but distinct and raised beneath.

Santal Parg.! Along streams, sometimes in thick forest.

Var. *β.* (In some respects this agrees better with *S. acmophylla, Boiss.*)

A m.s. or large tree with narrowly lanceolate leaves serrulate or entire with cuneate or rounded base, quickly glabrescent, very white beneath, sec. n. as many or more than in last but obscure and not raised beneath.

The commoner form.

Baskets are made from the branches.

FAM. 127. CASUARINACEÆ.

Trees or shrubs with cylindric grooved jointed branchlets and leaves reduced to subulate scales connate at base and forming short sheaths at the nodes. Flowers very minute, monœcious.* Males in slender terminal spikes formed of numerous (finally) whorled subulate bracts adnate to the rhachis, each bract subtending a flower consisting of 1–2 median scarious tepals and a pair of (lateral) bracteoles, stamen 1 with short filament and large anther. Fem. in ovoid or globose heads terminating abbreviated lateral branchlets, heads with whorls (members of one whorl alternating with those of next so that the bracts appear spiral, as they do in the *very young* male spikes) of small bracts subtending pairs of very small, finally accrescent, lateral bracteoles. Perianth 0. Ovary of 2 median carpels with an anterior fertile cell and a posterior barren cell or the latter suppressed,† stigmas 2 filiform very long. Ovules in the fertile cell 2, orthotropous, basal or sub-basal. Fruits together forming a cone with the achenes enclosed in the pairs of greatly enlarged coriaceous or woody bracteoles which open when the winged seed is ripe, wing terminal. Testa fused with the wall of the achene, albumen 0. Cotyledons flat equal, radicle very short, superior.

1. CASUARINA, *Forst.*

(The only genus.)

1. **C. equisetifolia,** *Forst.* Jamu, *Or.*; Bilaiti-jhau, *Beng.*; Beefwood Tree.

A large and handsome tree with drooping branches, very slender sulcate branchlets with whorls of 6–8 scale-like leaves, the internodes ·2–·3″ long on the branchlets, only ·1″ on main shoots which are tomen-

* *Hooker*, under *C. equisetifolia* in *F.B.I.* says "dioecious?." *Prain* in *Bengal Plants*, probably following *Roxburgh*, says dioecious (without the query), but the trees growing in the Calcutta Gardens are certainly *monœcious*, and I have never seen them otherwise.

† *Vide Engler* in *Nat. Pflanz. Fam.*

tose with recurved subulate-setaceous scales ·1″ long and usually 8 in a whorl. Male spikes usually numerous at the ends of the same branches on which the females are borne lower down, ·5–·9″ long, slender cylindric or slightly fusiform, bracts subulate with pubescent margins. Fem. heads in flower only ·1–·15″ long, ellipsoid, terminating short lateral branchlets below the male branchlets. Fruiting head ·5–·75″ long having a general superficial resemblance to that of a coniferous tree.

Often planted but especially on the sandy soils of the Puri coast, where it is rapidly becoming important. Fl. May. Fr. appears to ripen irregularly from June onwards (possibly from flowers of previous year).

Attains 6–7 ft. girth. The branches are dimorphous, those with the longer internodes being deciduous. Male anterior tepal scarious ·02″ long only, larger than the posterior, slightly hooded over the young anther. Flowering female heads tomentose, bracts subulate externally erect, with a broad horizontal base internally which becomes woody in fruit but the rest of the bract remains unchanged and is scarcely visible in fruit, stigmas exceeding the head, flexuous, bracteoles at first minute in flower, finally ·25″ long, valvately closed till the seed is ripe and projecting as sharp-edged bosses. Seed with wing ·18″ long.

The plantation of *Casuarina* at Puri was commenced in 1916 actually on the sea shore. Already however numerous trees along the Orissa coast showed that the locality, which is nearly pure sand, would grow *Casuarina*. At Konarak on rocky soil trees said to have been planted in 1905 showed growth equivalent to 3″ girth per annum. Some plants of 3·5 years old were about 25–30 ft. high. Large *Casuarina* occur on the sea face in the Mahanadi delta, but although *Casuarina* is said to be native on the Chittagong coast, there is no evidence that it is native on the Orissa coast and natural reproduction has not been observed. In South India the growth is probably faster and the average age of felling is said to be 10 years. *Gamble* gives the weight as 50–60 lbs. and says that it is hard and difficult to work.

FAM. 128. CERATOPHYLLACEÆ.

Slender submerged water plants with whorled leaves 2–several-times forked, segments filiform denticulate on the outer edges. Flowers minute. Male and female axillary, on the same plant, usually solitary and irregularly scattered, rarely 2 males in one whorl. Perianth (or involucre) of 6–12 narrow subvalvate appendaged (or 2-fid) segments usually pale in the M., green in the Fem. Stamens in the M. 12–30 on the convex receptacle, with very short thick filaments and erect extrorse 2-celled anthers, connective truncate or 2–3-toothed at the top. Ovary in the Fem. of 1 ovoid carpel, 1-celled, with a subulate style stigmatic on one side and a solitary pendulous straight ovule. Fruit a small coriaceous ovoid or ellipsoid somewhat compressed nut terminating in the elongate subulate persistent style, often also with two sub-basal styliform appendages. Seed with scanty albumen. Embryo with 2 straight cotyledons, the first 2 leaves of the plumule decussate with them, radicle very short inferior.

Note.—This family appears to have affinities with the *Ranales*. There is only one genus.

1. CERATOPHYLLUM, *L.*

1. C. demersum, *L.*

A water weed superficially like a submerged *Myriophyllum*, collapsing in a tassel when removed from the water, 6″ to 3 ft. long, densely

leafy. Leaves once or twice bifurcate, ·5–1″ long, segments ·01–·03″ broad, showing transverse partitions with a strong magnifying glass, and outer toothed edges. M. fl. in separate axils from the female. Perianth irregularly 10–12-fid, stamens 10–30, anthers large white with white watery pollen. Ovule showing through the translucent ovary. Easily recognised in fruit by the pedicelled ellipsoid, often dotted, nuts ·15″ long, furnished with one terminal and 2 sub-basal appendages much longer then the nut, some small accessory spines also sometimes present.

Probably common throughout the province (as throughout India) in still waters, but usually only flowering in shallow water. Fl., Fr. apparently most of the year.

Several sub-species or varieties (possibly species) exist, but the material from Bengal is excessively meagre and there are no specimens actually collected in our province either at Kew or Calcutta. The plant occurs in Europe.

CLASS.—MONOCOTYLEDONES.

FAM. 129. ALISMACEÆ.

Marsh or water plants supplied with laticiferous vessels, usually with a thickened rhizome. Leaves radical, floating or aërial, palmately nerved or nerves parallel. Flowers regular, 1–2-sexual, mostly verticillate in branched radical inflorescences. Calyx and corolla distinct, each of 3 members or corolla 0. Stamens 6-many, hypogynous or perigynous, anthers erect basifixed, 2-celled, extrorse or (*Butomeæ*) introrse. Carpels 3–6 or more, 1-celled, free, sometimes stipitate, styles and stigma simple. Ovules 1, 2 or many in each carpel, anatropous with 2 integuments. Fruit of achenes or follicles. Seeds small, exalbuminous. Embryo straight or conduplicate.

I. Ovules solitary, basilar. Fruit of achenes:—
  Fls. 2-sexual. St. 6-9. Receptacle flat . . . . . 1. *Alisma.*
  Fls. polygamous. St. 6. Receptacle flat . . . . . 2. *Limnophyton.*
  Fls. 1-sexual. St. many. Receptacle elevated . . . 3. *Sagittaria.*
II. Ovules several on the inner wall. Fr. follicular:—
  Stamens 8–12 . . . . . 4. *Butomopsis.*

1. ALISMA, *L.*

Scapigerous herbs with lanceolate, cordate or sagittate leaves and delicate white or pink 2-sexual flowers arranged in branched whorls on a pyramidal panicle. Sepals 3 persistent. Petals 3 deciduous. Stamens 6 or 9. Carpels few to many on a small flat receptacle. Ovule solitary, basilar in each carpel. Fruit of coriaceous or hard achenes. Seed erect with membranous testa and horseshoe-shaped embryo.

I. Leaves always longer than broad, rarely subcordate, 5-7-nerved . . . . . 1. *plantago.*
II. Leaves sometimes broader than long, cordate, over 10-nerved:—
  Leaves coriaceous, rounded. Style slender persistent . . 2. *reniforme.*
  Leaves membranous, acutely lobed. Style very short deciduous . . . . . 3. *oligococcum.*

1. A. plantago, *L.*

A large marsh herb 1–4 feet high with the panicle. Leaves 6–8″ erect or spreading, mostly lanceolate or ovate-lanceolate 5–7-nerved, but varying to linear or subcordate. Flowers ·3–·4″ diam. very delicate, in panicled whorls. Achenes numerous, over 20, membranous, compressed; style slender, deciduous.

Marshes and ponds. Towards the Nepal boundary from Bettiah to Purneah. Fl. c.s. Annual in our area! and never attaining the dimensions of the English plant.

2. A. reniforme, *Don.*

Habit of *A. plantago*, with an annual stem and 13–15-nerved orbicular-ovate leaves 2·5″ by 2″ to 4·5″ long by 6·5″ wide (broader than long), with rounded or retuse tip. Flowering stems 12–30″, branches 3–4 or usually 6 in a whorl with bracts up to ·5″ long in the lowest whorls. Flowers white or pink-purple, ·5″ diam. Fruiting

sepals persistent. Achenes 5–8 turgid, not whorled, ·08″ long awned with the style, obovoid and dorsally ribbed.

Marshes. Throughout the plains of India according to the *F.B.I.* The nearest locality to our area whence there is record of its collection is the Tarai and it will probably be found in Purneah.

3. A. oligococcum, *F. Muell.*

Similar habit or, apparently, sometimes submerged with very flaccid leaves. Leaves 3–6″ by 2–3″ membranous broadly ovate with cordate base, acute lobes and narrow sinus, 11–17-nerved. Panicle much smaller, 6–9″ long and broad, at once recognisable from the large lanceolate bracts of the lower whorls which attain 2–3″ long. Fruiting carpels whorled, ·08″, ridged and muricate.

From the United Provinces to Bengal, probably therefore in our area. Fl. Sept.

2. LIMNOPHYTON, *Miq.*

Characters of *Alisma* but flowers polygamous. Seed with very woody endocarp and with a hole on each side between the endocarp and the exocarp.

1. L. obtusifolium, *Miq.*

A dwarf or robust marsh herb with many-nerved reniformly-sagittate to triangular with lanceolately lobed leaves 6–12″ by 4–8″. Petiole 1–3 ft. long. Flowers numerous, white, ·3–·5″ diam. in whorls on the branches of a large panicle 2–4 ft. long (with the peduncle). Upper whorls mostly male, lower 2-sexual. Achenes in a globose head ·5–·75″ diam., obovoid, turgid with fleshy epicarp wrinkled when dry.

Marshy places, tanks, etc. Bengal, *Griffith* (without locality)! Chiefly in lower Bengal. *Kurz*, etc.! and as it extends to the Deccan and Saharapur probably occurring in Orissa. Fl. Feb. Fr. March, July.

The number of flowers or members in a whorl is very variable, only about 5 in weak specimens, crowded in strong ones. Bracts scarious. Pedicels in flower filiform.

3. SAGITTARIA, *L.*

Aquatic herbs, erect in shallow water or with submerged and floating leaves in deep water, often cordate or sagittate. Flowers rather large, 1-sexual or polygamous in panicled or spicate whorls. Sepals 3 herbaceous. Petals 3 deciduous. Stamens 6 or more with filiform compressed filaments. Carpels very many, laterally flattened, crowded on a large globose or oblong receptacle. Style ventral or apical, stigma papillose. Ovule solitary, basilar. Fruit a globose or oblong head of flattened crested or winged achenes. Embryo horse-shoe-shaped.

Leaves usually hastate or sagittate. St. about 24 in M. fl. Achenes with an entire wing . . . . . 1. *sagittifolia.*
Leaves broadly ovate deeply cordate. St. 6–10 in M. fl. Achenes with a broad toothed wing all round . . . . . 2. *guayanensis.*

1. S. sagittifolia, *L.* Arrow-head.

An aquatic with the leaves in deep running water strap-shaped, when floating with lanceolate or elliptic blades and in shallower water

emerging and with a hastate or sagittate blade 2–8″, usually 4–6″ long, usually acute with more or less diverging basal lobes. Petiole very spongy, 3-gonous. Flowers ·5–·75″ diam., white with usually purple centre, sessile or shortly pedicelled, upper male with longer pedicels, in 3–5 whorls of 3–5 flowers each on a scape 6–more inches long. Achenes in a globose head ·6″ diam. obliquely obovate, flattened, with broad entire or subcrenate wings.

Purneah! Monghyr, *Kew Herb.*! Sarguja, *Wood*! Fl. c.s.
The plant extends to England where it is common in some parts.
Stoloniferous with the stolons ending in a tuber. Petals ·3–·4″ long. The stamens are about 24 in the male fl., reduced to staminodes in the female flowers. *Prain.*

2. **S. guayanensis,** *H.*, *B.*, and *Kunth.* Syn. S. cordifolia, *Roxb.*

Leaves apparently always floating (?), broadly ovate, deeply cordate, obtuse or rounded, 1–4″ long by 1–3·5″ broad, with rounded auricles and obscure radiating nerves. Petiole long or short, often hairy, as are the scapes and pedicels. Flowers white ·7″ diam., in few close irregular whorls, usually ternate, the 2-sexual 9–12-androus, the upper male more numerous 6–12-androus. Petals obovate erose. Achenes flat, surrounded by a broad prominently toothed wing.

Purneah, *King*! Birbhum, *McLelland*! Ranchi, *Mokim*! Hazaribagh, *Clarke*! Fl. Aug.–Oct.
Roots a dense fibrous tuft, apparently annual. Leaf sheaths very broad, then rather suddenly contracted to the long flexuous petiole. Leaf nerves about 9, distinct when dry, reticulate between. Anthers cordate at base (they are rather sagittate in *sagittifolia*).

4. BUTOMOPSIS, *Kunth.*

A scapigerous marsh herb somewhat resembling *Alisma* in habit, with elliptic leaves. Flowers in bracteate whorls or a terminal umbel. Sepals 3 persistent. Petals 3 white membranous fugacious. Stamens 8–12 with oblong anthers. Fruit of 4–6 (6–7, *F.B.I.*) erect membranous follicles. Seeds very many, minute, smooth.

1. **B. lanceolata,** *Kunth.* Syn. Butomus lanceolatus, *Roxb.*

Erect 8″ to 2 ft. high with erect lanceolate or elliptic 3–7-nerved leaves 2–6″ long with very long petioles enclosed by sheaths below. Scape far exceeding the leaves usually with a single terminal whorl of about 5 flowers ·75″ diam. on very long but unequal pedicels 1–4″ long. Sepals oblong-ovate, wrapping round the young fruit. Follicles shortly beaked, ·35″.

Rather common in wet places, rice-fields, etc. Sikkim tarai, near Purneah! Ranchi! Singbhum! Manbhum! Probably in all districts of the provinces. Fl., Fr. Sept.–Jan.

FAM. 130. NAIADACEÆ.

Aquatic herbs of various habit. Leaves simple, opposite or alternate entire or serrate, submerged or floating, sheathing and sometimes stipulate at the base. Flowers inconspicuous, usually green, 1–2-

sexual, in spikes or racemes more rarely axillary solitary or clustered, rarely dioecious, sometimes inflorescence included in a spathe. Perianth 0, or of 3–4 valvate tepals or tubular and almost hyaline. Stamens 1–6, hypogynous in the 2-sexual flowers, solitary or connate in male flowers, anthers 1–2-celled. Carpels 1–6, style long or short, stigma various. Ovule 1 in each cell carpel, rarely (*Aponogeton*) 2 or more, erect or pendulous. Fruit of 1-seeded achenes, drupels or (*Aponogeton*) follicles. Seed exalbuminous, embryo straight or curved, radicular end very large.

The description of the Family excludes the *Juncaginaceæ*, but includes the *Potamogetoneæ* and *Aponogetoneæ* which are treated as separate families by some botanists.

I. Flowers 2-sexual :—
  A. Perianth consisting of 1–4 sepals :—
    Sepals 1–3, white or coloured, membranous. St. 6 or more . . . . . 1. *Aponogeton.*
    Sepals 4,* herbaceous, green, anthers 4 sessile . . . 2. *Potamogeton.*
  B. Perianth 0. Anthers 2, sessile . . . . . 3. *Ruppia.*
II. Flowers 1-sexual or dioecious. Stamen 1 :—
  Perianth 0. Style long with oblique peltate stigma. Achenes 2-9 . . . . . 4. *Zannichellia.*
  Perianth hyaline. Stigmas 2–4 sessile, slender. Achene one . . . . . 5. *Najas.*

1. APONOGETON, *L. f.*

Aquatics with tuberous rootstock and submerged or floating leaves longitudinally nerved and with numerous transverse nervules, membranus. Flowers 2-sexual on long scapes bearing solitary or geminate, often unilateral spikes enclosed when young in a conical deciduous sheath. Perianth rarely of 3 segments, usually 2 or only 1, white or coloured, deciduous or (if only one) with persistent broader accrescent base. Stamens usually 6 in two whorls, seldom more in 3–4 whorls, unequal. Carpels usually 3, seldom 4–6, with short or long style and discoid or decurrent stigma. Fruit coriaceous follicular. Ovules 2 basal, or several 2-seriate on the ventral line, anatropous. Seeds erect exalbuminous, embryo straight.

Leaves floating, oblong, 3-5-nerved. Tepals 2 shorter than the 4–8-seeded follicles . . . . . 1. *monostachyon.*
Leaves submerged, lanceolate to linear-oblong, 3–7-nerved.
  Tepals 1–3, white, longer than the 1–2 seeded follicles . . 2. *crispum.*

1. A. monostachyon, *L. f.* Ghechu, *H.*

Rootstock about 1″ by ·3–·5″ diam. stoloniferous. Leaves floating, oblong, more rarely linear-oblong, 2·5–8″ by ·75–1·5″, acute or obtuse with cuneate rounded or cordate base, 3–5-nerved, petioles sub-3-gonous. Spike solitary on the scape, 1–6″ long by ·2″ diam. with white, pink or pale-blue flowers. Tepals 2, obovate or suborbicular, ·1″ long. Stamens 6 with bluish-purple anthers. Carpels 3. Follicles exceeding the tepals, smooth with 4–8 oblong seeds.

Behar, *Hope*! Widely distributed in India and is found both sides of our area, and probably occurs in most of the districts. Fl., Fr. most of the year.
The flowers are very pretty. The rootstock contains much starch and is eaten.

* Sepals, or possibly sepal-like appendages to the connective of the anthers.

2. **A. crispum,** *Thunb.* Syn. A. undulatum, *Roxb.*

Rootstock stoloniferous. Leaves submerged (or floating, *Roxb.*) lanceolate to linear-oblong, 4–6″ long, under 1″ broad, 3–7-nerved with compressed petioles. Cross nervules very fine and numerous. Scape thickening upwards, spike solitary, 1·5–3·5″ long. Flowers crowded white. Tepals up to ·3″ long, very variable in size (*F.B.I.*). Follicles shorter than the tepals, 3–4, smooth, 1–2-seeded.

Extends from the United Provinces and Central Provinces to Lower Bengal, and therefore almost certainly to be found in our area. Fl. r.s.

The *F.B.I.* states that the leaves are 1–3 ft. long. Some Madras specimens have leaves 14″ by 1·1″, but these are the largest I have seen. The spikes just raise themselves above the water. Stamens lilac. The rootstock is edible.

2. POTAMOGETON, *L.*

Aquatics with a creeping rootstock, elongate submerged stem and submerged or floating, opposite or alternate, entire more rarely toothed, leaves and intrapetiolar stipules. Flowers greenish, spicate on a lateral peduncle rising above the surface of the water from a membranous spathe or sheath, ebracteate, 4-merous throughout. Sepals 4 concave, green, valvate. Anthers sessile on the sepals (or according to some authors the so-called sepals are merely scales developed at the back of the anthers) didymous, with a cell each side of the claw, extrorse. Carpels 4 sessile, 1-celled, 1-ovuled with subsessile or decurrent persistent stigma. Ovule inserted in the inner angle, camplotropous. Fruit of 4 coriaceous or spongy drupels with reniform seeds.

I. Leaves, at least the upper, floating, oblong or elliptic :—
  Floating leaves coriaceous 3–4″ long, submerged lanceolate — 1. *indicus.*
  Floating leaves ·5–1·5″ long, submerged linear or filiform . . — 2. *javanicus.*
II. Leaves all submerged, oblong lanceolate or linear (exc. *perfoliatus*) :—
  A. Leaves ovate, cordate, amplexicaul . . . . . — *perfoliatus* (p. 848).
  B. Leaves lanceolate or oblong :—
    L. subamplexicaul, 3-nerved, crisped and serrulate . . — 3. *crispus.*
    L. neither amplexicaul nor crisped, 5- or more-nerved . . — 4. *mucronatus.*
  C. Leaves narrowly linear or filiform :—
    L. 1-3-nerved. Stipules adnate to leaf-sheath . . . — 5. *pectinatus.*
    L. 3-5-nerved. Stipules small, free . . . . . — 6. *pusillus.*

1. **P. indicus,** *Roxb.* Indian Pond-weed.

Stem slender terete, branched. Leaves nearly all floating in shallow water, upper ones only in deep water, elliptic or oblong or elliptic-lanceolate 2·5–4″ by 1–1·75″, rounded obtuse or acute both ends, rather coriaceous, shining with strong midrib and many more slender parallel nerves mostly proceeding from near the base, petioles 1–4″, stipules free 1–1·5″; submerged leaves lanceolate, undulate, membranous and often elongate (up to 8″, *Cooke*), petioles shorter. Spike ·7–1·5″ long on axillary or leaf-opposed peduncles which raise it just above the water. Flowers densely packed without spaces between the whorls. Sepals (or scales of anther ?) ·1″ long including the long claw, limb suborbicular concave about ·08″ diam. Drupels ·12″ long, obliquely truncate, shortly beaked.

Common in tanks in Chota Nagpur! Shahabad, *J.D.H.*! Probably to be found in all districts of the province but not collected. Fl. Aug.–Jan., perhaps all the year round. Fr. found in April and May, and usually fruits soon after flowering. The plant closely resembles the common English *P. natans*.

Leaves mostly broadly elliptic and obscurely 13–15-nerved from the base; some Behar specimens have, however, lanceolate-elliptic leaves about 3·3″ by 1·3″.

2. P. javanicus, *Hassk.*

Different looking, more slender than the last and with much smaller leaves, ell.-oblong, ovate-oblong or elliptic, acute both ends, or subobtuse, 5–7-nerved including the midrib, ·5–1·5″ long and petiole shorter; stipules ·5–1″; submerged leaves linear acuminate or filiform. Spike ·3–·5″ long with flowers smaller than in *P. indicus* and the whorls more distant, peduncle as long or longer than the spike, very slender. Sepals orbicular-obovate. Drupels semi-globose ·08″ long with stout hooked beak and ribs often toothed or tubercled.

Shahabad, *J.D.H.*! to Sikkim Tarai! Chilka Lake, *Lawson*! Probably also in other parts of the province. Fl., Fr. Dec.–March.

3. P. crispus, *L.*

Stems slender, compressed, dichotomously branched with distichous half-amplexicaul close-set oblong to linear acute or obtuse leaves 1–3″ or up to 5″ long, ·1–·3″ broad with crisped and serrulate margins, 3-nerved. Petiole 0, stipules small obtuse caducous. Spike very small ·2–·3″ long, only 6–8-fld. Peduncles over 1″ and exceeding the upper leaves. Flowers very small, sepals ·8–·1″ with the claw. Drupels obliquely ovoid, ·1–·12″ (·2″ in English specimens), compressed acuminate with straight beak.

Behar, *J.D.H.*! Not uncommon in Chota Nagpur! Fl. Dec.–April.

P. perfoliatus, *L.*, occurs in the United Provinces not far west of our area and will probably be found within it. The leaves are amplexicaul, ovate, cordate, ·7–3″, upper opposite, 5–9-nerved. Spike dense-fld.

4. P. mucronatus, *Presl.*

Leaves all submerged, petioled, elliptic- or oblong-lanceolate or linear-oblong 3–7″ by ·5–·7″, acute or cuspidate, with a long point, 5–9- or more-nerved with acute or obtuse base. Petiole one-half or one-third as long as the blade. Stipules 1–1·5″, exceeding the petiole. Spike 1–2″ of interrupted groups or whorls of flowers, very long-peduncled. Sepals suborbicular, very shortly clawed. Drupels half-orbicular, shortly beaked.

Chaibassa tank, Singbhum, *Wood* (*Rec. Surv. Ind.*).

5. P. pectinatus, *L.*

Stem filiform, copiously distichously branched with filiform very flaccid submerged alternate leaves 1–6″ by ·1″ or much less, opaque with slightly thickened or inrolled margins, 1–3-nerved, sometimes ·2″ broad and 5-nerved (*F.B.I.*). Sheaths up to 7-nerved. Stipules adnate to the leaf sheath with free points only. Flowers interruptedly whorled on a spike ·2–1″ with long filiform peduncle. Drupels dimidiate-obovoid, slightly convex ventrally, with strong lateral ridges and when dry sometimes obscurely keeled dorsally, hardly beaked.

Behar, affluents of the Soane. *J.D.H.*! Patna, *Wall. Cat.* 5179 *b*, part! Tirhut and N. Bengal (*fide Beng. Pl.*), but I can find no specimens in the *Cal. Herb.* Fl. Nov.-Jan. It is frequent in ponds and streams as far as the British Isles.

6. P. pusillus, *L.*

Much 2-chotomously branched with very filiform stems. Very like *P. pectinatus* but leaves flat without inrolled margins, filiform, 1–3-nerved. Stipules free. Peduncle long filiform. Flowers and flower-clusters very minute. Drupels turgid obliquely ovoid with a broad dorsal keel.

Patna, *Hamilton*, in *Wall. Cat.*, No. 5180 *b*!

Sub.-sp. *flabellatus* with 3–5-nerved leaves ·08″ broad is recorded in *F.B.I.* and *Bengal Plants*. This is a slip; that part of *Wallich's* No. 5179 *b* which is *flabellatus* is from Nalagola, the other part from Patna is *P. pectinatus* (*P. marinus? Hamilton*).

P. pusillus is common in the British Isles and forms "a tangled mass of thread-like stems and dull, olive-green leaves with numerous spikes of brownish flowers which are either submerged or partially rise above the water." *Rev. Johns.*

3. RUPPIA, *L.*

Slender aquatics growing in brackish water with elongate filiform submerged leaves with stipular sheaths. Flowers minute, 2-sexual, 2–6 together within the leaf-sheath, peduncle usually greatly elongating becoming far exserted and often spirally twisted after flowering. Perianth 0. Anthers 2 sessile, opposite, 2-celled with large kidney-shaped cells soon deciduous from the connective. Carpels 4 with sessile stigma. Ovule 1 pendulous. Achenes long-stipitate, ovoid, obtuse or beaked. Seed uncinate.

1. R. rostellata, *Koch.* Syn. R. maritima sub. sp. rostrata, *M.* & *K.*

Stems very filiform, branched. Leaves 1–3″ long, nerves not evident. Fruiting peduncle of very variable length, often attaining several inches, straight. Achenes with very slender stipes attaining 1″ in length, spreading divergent, obliquely ovoid acutely beaked.

In brackish water. No specimens have been collected from our area, but it occurs throughout India and has been collected by *Kurz* near Calcutta, so that it will almost certainly be found in Orissa. *R. maritima*, which differs but slightly is frequent in brackish waters in Britain.

4. ZANNICHELLIA, *L.*

Aquatics growing submerged in fresh or brackish water with a very slender rootstock and filiform stems cymosely branched at the flowering nodes. Leaves narrowly linear or filiform, pseudo-verticillate at the flowering nodes, with stipular membranous sheaths. Flowers minute, monœcious. Female terminal on an abbreviated shoot enclosed in the stipular leaf-sheath and bearing 2 foliage-leaves below it: one of these bears an axillary male flower, the other a shoot which continues the branching. Male fl. subtended by a spathe (which may be merely the sheath of its leaf: the *F.B.I.* states that both flowers are included in one spathe) and consisting of a solitary stamen with sagittate anther and slightly excurrent connective. Fem. fl. with a hyaline tubular perianth containing 2–6, rarely more, carpels each with a peltate deflexed large stigma and a pendulous orthotropous ovule.

Achenes compressed-sausage-shaped, 2–4, sessile or stipitate, often crenulate spinulose or echinate on the dorsal line and horned with the persistent style. Embryo folded, radicle fold clavate, cotyledonary end tapering slender and twice folded or uncinate.

1. **Z. palustris,** *L.* The Horned Pond-weed.

A variable aquatic with the characters of the genus. The Indian plant is included in sub-species *pedicellata Hook. f.* (Syn. *Z. pedunculata, Reichb.*, and *Z. pedicillata, Ham.*) Male peduncle short, achenes 2–4, subsessile, back crenate or tubercled, style as long as the body of the achene or longer.

Behar, *J.D.H.*! Fl. c.s.

In the Behar plant the flowers are sessile, achenes stipitate, smooth or tubercled dorsally or ventrally or both, style very long.

The plant extends to Britain and it is from British specimens that I have somewhat modified the generic characters given in the *F.B.I.*

5. NAIAS, *L.*

(Or *Najas.*)

Slender submerged aquatic herbs with a slender creeping root and usually filiform branched stems. Leaves opposite alternate or 3-nately whorled, linear, usually serrulate or sinuate-dentate, base shortly sheathing. Flowers minute, axillary, monœcious or dicœcious. Male perianth double, an outer tubular or inflated entire or 4-fid tube and a hyaline inner. Stamen 1, adnate to the inner, central, apiculate or cuspidate, 1- or 4-celled. Fem. perianth 0 or hyaline and adherent to the carpel which is solitary sessile with 2–4 slender stigmas. Ovule 1 basal erect anatropous. Fruit an oblong achene. Seed with thin testa and straight embryo with large hypocotyledonary axis and radicle and well-developed plumule.

The key and greater part of the descriptions have been taken from *Rendle.*

A. Flowers dicœcious. L. ·1–·15″ wide, strongly toothed . . . 1. *major.*
B. Flowers monœcious. Leaves under ·1″ wide, teeth very small:—
  1. Fls. of both sexes surrounded by a spathe . . . . . 2. *indica.*
  2. Fls. of male only with a spathe. Leaf-sheath truncate or auricled at mouth:—
    a. Anthers 1-celled:—
      Areoles of testa broader than long (scalariform) . . . 3. *minor.*
      Areoles of testa isodiametric . . . . . 4. *Kurziana.*
    b. Anthers 4-celled . . . . . 5. *foveolata.*
  3. Fls. of both sexes naked . . . . . 6. *graminea.*

1. **N. major,** *All.*

A stout species with the leaves ·1–·15″ wide almost pinnatifidly toothed, teeth 4–8 each side triangular. Sheath with rounded entire sides. Flowers dicœcious. Anthers 4-celled.

There are no specimens from our area, but it is said to be found everywhere in both fresh and brackish water, and is likely to occur in Orissa.

2. **N. indica,** *Cham.* Syn. N. minor *F.B.I.* (in part); N. minor var. indica, *A. Br.*, and N. tenuis, *A. Br.* (The Behar Plant.)

A very slander lax aquatic with filiform stems and filiform or very narrowly linear often setaceous leaves ·9–1·3″ long with very fine

marginal teeth 10–17 each side. Leaf-sheath with rounded auricles or subtruncate or broadly orbicular, minutely toothed. Flowers monœcious, both sexes surrounded by a spathe with a long neck and irregularly toothed mouth, ·16–·2″ long. Seed ellipsoid 2 mm. long, with numerous minute 4–6-gonal areoles in 25–30 longitudinal rows.

Shahabad (moat, Shahganj) *J.D.H.*!

Typical specimens from Faridpur and Jessore have the teeth evident; the leaves in the Behar plant are very narrow and the teeth sometimes obscure. The teeth are always very fine as compared with the next species.

3. **N. minor,** *Allione.* Syn. Caulinia fragilis, *Willd.*; N. dichotoma, *Roxb.*

A more graceful plant than *N. indica*, the leafy branches closer and more tufted, much 2-chotomously branched. Leaves recurved, very narrowly linear and attenuate to tip, ·4–·8″ long with the 6–10 teeth each side spreading from a broad base and with a finely spinulose tip. The sheathing stipular bases of the leaves are prominent in this species with rounded often denticulate shoulders or truncate. Seed 2–3 mm. long, obliquely linear-oblong, scarcely areolate but sculptured with 12–18 longitudinal scalariform bands.

Western Bengal, *Kurz*! Sikkim Tarai, *Kurz*! Chilka Lake, *Annandale*! Fl. March. Probably occurs throughout the province.

Male flowers only with a spathe. Anthers 1-celled.

4. **N. Kurziana,** *Rendle.*

A small species with very graceful stem and slender leaves about 15 mm. (·6″) long with very numerous close minute teeth. Sheath shortly auricled. Male flower only with spathe. Anther 1-celled. Seed ellipsoid-oblong conspicuously areolate, areoles quadrate in about 16 series.

Purneah, *Kurz*! Fl. Sept.

5. **N. foveolata,** *A. Br.*

Stems branched and spreading with linear leaves narrowed and setaceous above ·7–1·5″ long with 6–20 small subtriangular oblique and very sharp teeth each side. Sheath shortly auricled or with minutely toothed shoulders rather than auricles. Male flower only with spathe, anther 4-locellate. Seed 2·25–2·5 mm. long, areoles distinct in about 20 longitudinal rows, the centre ones subquadrate.

Tanks and streams, abundant. Bengal, *Kurz*! Bihar, *J.D.H.*! Fl. Feb.

6. **N. graminea,** *Del.*

A short grass-like, often gracefully plumose aquatic. Stems up to 2 ft. with densely foliose branchlets. Leaves narrowly linear ·7–1″ long with numerous (30–50) minute oblique spinules each side. Sheath long-auricled very conspicuous, auricles lanceolate denticulate. Flowers of both sexes naked. Seed narrowly oblong to ellipsoid-oblong 1·75–2·25 mm. long. Areoles subquadrate or polyhedral, small, irregularly disposed or in more or less distinct longitudinal lines.

A very common and widely distributed plant. Ranchi, *Mokim*! Fl. Sept.-Oct.

FAM. 131. HYDROCHARITACEÆ.

Aquatic herbs with simple undivided leaves with 1 to many basal nerves. Flowers minute to showy, monœcious or diœcious, enclosed in a spathe, female solitary. Sepals 3, green or petaloid. Petals membranous or 0. Stamens 3–12, anthers 2-celled. Ovary inferior, placentæ parietal or almost meeting in axis, styles or stigmas 3–12. Ovules anatropous or orthotropous. Fruit membranous or fleshy, rarely dehiscent. Seeds few to many, exalbuminous. Embryo various.

I. Stem branched leafy. Spathes short sessile :—
  Leaves whorled. Perianth double. Ovules anatropous . 1. *Hydrilla.*
  Leaves alt. Perianth single. Ovules orthotropous . . 2. *Lagarosiphon.*
II. Stemless or with stolons bearing sessile tufts of leaves or with creeping rootstock :—
  A. Leaves grass-like without distinct petiole, spathes on long radical very slender peduncles :—
    Perianth single. Fls. 1-sexual . . . . . 3. *Vallisneria.*
    Perianth double. Fls. 1-2-sexual . . . . . 4. *Blyxa.*
  B. Leaves broad, petioled. Spathes peduncled :—
    Tufts of leaves floating. Male spathes 2-3-fld. Ovary not beaked . . . . . 5. *Hydrocharis.*
    Rooting at the bottom. Leaves submerged and floating. Spathes 1-fld. Ovary beaked . . . . . 6. *Ottelia.*

1. HYDRILLA, *Richard.*

Submerged, leafy, diœcious or monœcious, with short whorled leaves or the lower opposite. Male fl. solitary, shortly pedicelled, in a subglobose sessile muricate spathe, sepals 3, ovate or obovate, green ; petals 3 oblong or cuneiform ; stamens 3, anthers large reniform, opening elastically, pollen large white firm, pistillode small. Fem. fl. 1–2, sessile in a tubular 2-toothed spathe ; hypanthium produced into a long filiform neck above the ovary, perianth as in male but the segments narrower ; ovary 1-celled, styles 2–3 linear, stigmas fimbriate. Ovules anatropous. Fruit subulate, smooth or muricate. Seeds 2–3 oblong, testa shortly produced each end.

1. H. verticillata, *Casp.*

A weak water-herb having a general appearance of *Elodea canadensis* and, like it, forming large masses suspended beneath the surface. Stems slender branched with linear or shortly-linear, usually spinulosely-serrulate, leaves ·25–·4″, rarely ·5″ long, 4–8 in a whorl, spreading with recurved tips.

In tanks and slow-running streams. No doubt in all districts. In the Ganges at Monghyr, *Lockwood* ! Behar, *Kew Herb.* ! Singbhum ! Cuttack, canals ! Raneeganj, *Kurz* ! Chilka Lake, *Cal. Herb.* ! Fl. July–Sept.

L. rarely ·5″ and narrow-elliptic. M.fl. in whorls sessile at the base of each leaf, escaping from the muricate spathe when mature and swimming on the surface. Fem. above the males if monœcious or in separate terminal branchlets (*Clarke*) and usually solitary in the whorl or opposite. Stigmas pink.

2. LAGAROSIPHON, *Harv.*

Submerged, diœcious, with alternate leaves or sometimes leaves fascicled or subverticillate and lower opposite, serrulate. Male fls.

minute, many in an ovoid 2-fid axillary sessile spathe, sepals petaloid, petals rather shorter, anthers 2–3, ovoid, 3 staminodes often present, pistillode 0. Fem. fl. solitary, sessile in a narrow oblong spathe, hypanthium produced into a long filiform beak above the ovary, perianth as in male, staminodes 0. Ovary oblong, styles 3, stout, notched. Ovules many, orthotropous. Fruit ovoid, oblong or linear, many-seeded.

1. L. alternifolia, *nov. comb.* Syn. Valisneria alternifolia, *Roxb.* Lagarosiphon Roxburghii, *Benth.*

A very slender waterweed with distant linear leaves 1″ or more (up to 4″ long and ·15″ broad). Male spadix transparent, finally 2-leaved, flowers on a short spadix, perianth reflexed and swimming on the surface when the anthers are ripe. Female with scarious 2-fid spathe wrapping round the lower part of flower, the pinkish perianth of which at the end of the long hypanthium floats on the water.

Many specimens from the old province of Bengal are found in herbaria without more precise locality and it is probably common in our area as it occurs in East Bengal! United Provinces, *Duthie*! Nepal, *Kew Herb.*! Calcutta! Peninsular, *Wight*! Fl. Aug.–Nov.

Clarke described the male fl. as with a 4-leaved external coloured perianth and a 2-leaved internal one so delicate as to be difficult to see. He also describes the M. fl. (from an unopened spathe) as a simple anther, "a bag containing a few large, white pollen grains." The habit is somewhat that of *Potamogeton crispus*.

3. VALLISNERIA, *L.*

Submerged tufted stemless stoloniferous herb with very long linear leaves. Dioecious. Male fl. very numerous, minute, in spathes projecting from the bases of the leaf-sheaths, spathes very shortly peduncled, sepals 3, petals 0, stamens 1–3, anthers didymous, pistillode 0. Fem. fl. solitary in a tubular spathe terminating a very long filiform spiral peduncle. Perianth as in male, staminodes 3, 2-fid. Ovary narrow, stigmas 3 broad, notched. Ovules many. Fruit linear, included in the spathe, many-seeded.

1. V. spiralis, *L.*

Leaves straight from the root, grass-like, flaccid, 3″–1 ft. long according to the depth of the water, longer about ·35–·5″ broad, wavy, translucent, entire or tips serrulate. Male spathes ovoid 3-lobed, ·2–·25″, breaking off at the base, when the flowers emerge and float on the surface. Fem. spathe with flower ·6″, floating on the surface when ready for pollination and again withdrawn beneath it by the spirally coiled peduncle to ripen the seed.

Bottoms of tanks and lakes. Behar, in the R. Soane and its affluents, *J.D.H.*! Hazaribagh, Bagodar, *Kew Herb.*! Between Calcutta and Agra, *Jacq.*! No doubt throughout the province, being distributed from the Punjab and United Provinces to Calcutta Fl. Jan.–May.

4. BLYXA, *Thouars.*

Habit of *Vallisneria* with linear acute, entire or minutely serrulate leaves. Dioecious or flowers 2-sexual. Male fl. several in a tubular 2-toothed spathe on long or short peduncles from the leaf axils; sepals 3, linear; petals 3, longer; stamens 3–9, 1 or more rudimentary,

anthers narrow erect, pistillodes 3 slender. Fem. fl. solitary in its spathe which is peduncled as in the male, hypanthium elongated above ovary, perianth as in male, staminodes 0 or minute. Ovary very slender, beaked with the hypanthium, style very short, stigmas 3 filiform, ovules many. Fruit very slenderly fusiform included in the ventricose ribbed spathe. Seeds many with mucilaginous testa.

A. Flowers dioecious:—
Stamens 8. (6–9). Seeds small, tails short or 0 . . . 1. *octandra.*
B. Flowers 2-sexual. Stamens 3:—
L. 6″–4 ft. Capsule 2–3″. Seeds with very long tails . . 2. *echinosperma.*
L. 4–6″. Capsule 1–1·5″. Seeds with very short tails . . 3. *oryzetorum.*

1. **B. octandra,** *Planch.* Syn. Vallisneria octandra, *Roxb.*; Blyxa Roxburghii, *Rich.*

Leaves 8–24″ long from the root, tapering to a fine point, minutely serrulate (always ?), ·5″ or less broad. Peduncles raising the flowers a little above the surface. Fls. dioecious. Male spathe open at the top, fls. white mod.-sized, opening in succession, pedicels lengthening when the fls. are ready to expand. Sepals green, lanceolate. Petals linear, recurved, more than twice as long as sepals. Stamens usually 8, unequal, erect, rudimentary carpels 3. Fem. fl. with scape shorter and thicker than in the male, but the elongated hypanthium brings flowers to the surface, petals more filiform. Capsule 2–4″ by ·17″. Seeds tubercled ·04″ with tails short or 0.

Distributed from the Central Provinces to Eastern Bengal and Khasia Mnts. to Madras and United Provinces, hence it is sure to occur in our area, though I have seen no specimens therefrom. Fl. Sept.

2. **B. echinosperma,** *Hook. f.*

Appears to have a denser tuft of leaves than the last, ·4–·5″ broad, very finely acuminate, more prominent nerves 5. Flowers all perfect, one in each spathe, the peduncle ultimately 1–3 ft. according to the depth of the water. Spathe long linear opening with a slit on one side, produced and tubular above the flower. Hypanthium sometimes 4·5″ long, on the top of which the "valvate sepals and long petals with their tips often spiral. Stamens 3 but only 2 antheriferous" (*Clarke*). Seeds spinescent and together with the slender tails ·5″ long.

Occurs at Comilla, Bengal, *Clarke*! and is also common in the tanks of West Kanara, *Talbot*! It is probably found in the intermediate area. Fl. Oct.

Talbot says "at the time of flowering the deep water plants become detached from the bottom and float on the surface."

3. **B. oryzetorum,** *Hook. f.*

A short tufted species with leaves 4–6″ long only, entire or microscopically serrulate or obscurely crenulate, tips filamentous. Flowers 2-sexual. Petals white linear with yellowish twisted ends. Stamens 3. Capsule 1–1·5″ by ·17″. Seeds sparsely but sharply tubercled, ·07″ long, tails very short or 0.

In rice fields. From United Provinces, *Kew Herb.* to Bengal, *J.D.H.*! and Khasia Hills, *Clarke*! Ranchi, *Prain*! Fl. Aug.

The Ranchi specimen has spreading rosulate leaves with filiform tips. The scape is described as very short but this would be expected from the habitat.

5. HYDROCHARIS, *L.*

Floating tufted stoloniferous herbs with orbicular or reniform entire leaves. Dicœcious. Male fls. 1–4 in a peduncled 2-leaved spathe, sepals 3 green, petals 3 membranous white. Stamens in 4 whorls of 3 each, the third whorl with sometimes only a one-celled anther, the fourth sometimes staminodial, in addition sometimes a fifth, often incompletely developed, whorl of staminodes, filaments forked, anther-cells basifixed. Centre of flower with 3 spherical glands. Fem. spathe 1-fid., flower long-pedicelled, perianth as in male, with nectaries at base of the petals. Staminodes 6 in pairs. Ovary ovoid, 6-celled, stigmas 6 linear, 2-fid. Fruit ovoid or oblong, fleshy. Seeds many with gelatinous testa full of spiral vessels. Embryo ovoid.

1. **H. asiatica,** *Miquel.* Syn. H. morsus-ranæ, *F.B.I.* in part; H. callulosa, *Ham*; The Frog-bit.

Very like the *H. morsus-ranæ*. A pretty floating aquatic with cordate or kidney-shaped leaves 1–1·5″ not unlike those of some *Limnanthemum*. Fls. about 1″ diam., M. only 1–2 in the spathes, antheriferous filaments usually 12 and 3 staminodes, filaments not adnate to those of the superimposed whorls. Petals in both sexes rather crumpled, very delicate.

Frequent in the Jalpaiguri district in still waters! and Rajshaye, *Clarke*! Probably therefore occurs in Purneah. Tirhut, *Prain*, but I have seen no specimen unless the place called Singur is in Tirhut. Fl. c.s.

6. OTTELIA, *Pers.*

Herbs with submerged and floating leaves, submerged usually narrow. Flowers large, solitary, sessile in a tubular 2-fid or toothed spathe and partially exsert from its apex. Hypanthium elongate. Sepals narrow. Petals larger broad, white or yellow, base with fleshy appendages. Stamens in 3 whorls of which the outer is double, or one or both the inner whorls often failing, anthers erect. Ovary oblong, beaked, nearly 6-celled from the intruded walls, styles 6 linear, 2 fid, ovules many all over the inner surface. Fruit 6-valved, enclosed in the spathe. Seeds many, oblong, testa pulpy.

1. **O. alismoides,** *Pers.* Syn. Damasonium indicum, *Willd.*

Rooting at the bottom of streams and tanks with flaccid floating and submerged bright green leaves and pretty white flowers with the perianth exserted from a crisped winged spathe, 1·5–2″ diam.

Very common in running streams. Purneah! Shahabad, Shahganj-moat, *J.D.H.*! Probably in all districts but flowering in the r.s. and not often collected, also sometimes fl. Sept.–Dec.

Leaves variable in shape, submerged sometimes oblong with tapering base or oblong-lanceolate and about a foot long, floating orbicular- or oblong- and cordate 6–7″ diam., on long succulent 2-edged petioles. Spathes on long axillary peduncles, tubular with about 6 wavy crisped wings, 1·5″ long by ·75″ diam., sharply 6-toothed or segments obtuse and cuspidate. Stamens 6 in three pairs. Fruit oblong, crowned with the withered perianth, 6-grooved, attaining ·2″ diam.

FAM. 132. ARACEÆ.

Herbs of very varied size, more rarely shrubby and then usually scandent, very frequently tuberous or rhizomatous with annual shoots, very rarely aquatic, usually quite glabrous and somewhat succulent. Tissues often with latex-tubes or raphides. Leaves usually rather fleshy, simple, lobed or palmately or pedately divided with generally palmate or pedate principal venation and frequently intermediate venation reticulate or of parallel arches; in the tuberous species solitary or few radical and sometimes appearing at a different season to the flowers, in the caulescent species distichous or spiral; membranous sheaths usually present at base of the petiole or peduncle. Flowers small to minute, crowded on a simple fleshy spadix with green or coloured spathe, rarely few (only one female fl. on spadix in the aquatic genus *Pistia*), 2-sexual or usually monœcious with the male and fem. infl. on different parts of the same spadix, very rarely diœcious. Spadix often produced beyond the flowers into an "*appendix*." Perianth 0 or inferior, cupular or of 4–8 segments. Anthers in hermaphrodite fls. 4–8, in monœcious fls. 1–many, often united into synandria and connective usually overtopping the cells. Ovary entire, most rarely lobed, 1–many-celled. Style 0 or various. Ovules 1 or several in each cell, basal, parietal or apical, rarely central; orthotropous or anatropous. Fruits mostly baccate, distinct or confluent. Seeds 1 to many with usually copious albumen (0 in *Pothos*) and axile embryo.

I. Flowers 2-sexual :—
  A. Perianth present. Stem often elongate. Raphides 0 :—
    Scandent. Perianth 6-phyllous. Ovary 3-celled, cells 1-ovuled . . . . . 1. *Pothos.*
    Caudex erect. Perianth 2-phyllous. Ovary 2-celled, cells 1–2-ovuled. Spathe often coloured . . . *Anthurium* (p. 858).
  B. Perianth 0. Scandent shrubs with abundant raphides :—
    Ovary 2-celled. Ovules 2-seriate. Berries many-seeded . . . . . 2. *Rhaphidophora.*
    Ovary 2-celled, cells with 2 basilar ovules . . . *Monstera* (p. 859).
    Ovary 1-celled with 1 basilar ovule . . . . . 3. *Scindapsus.*
  C. Perianth present. Erect prickly marsh herbs. Ovary 1-celled . . . . . 4. *Lasia.*

II. Flowers 1-sexual, monœcious (diœcious in some *Arisæma*). Perianth 0 :—
  A. Terrestrial with large leaves :—
    1. Caulescent (a thickened rootstock only in *Zantedeschia*) or scandent, sometimes shrubby. Leaves many. Stamens free or, if synandrous, then fem. fl. with staminodes. Garden plants :—
      a. Female fls. with 3–5 staminodes :—
        L. oblong or ovate-oblong, variegated. Stoutly caulescent. Ovary 2–3-celled and -lobed . . *Dieffenbachia* (p. 860).
        L. sagittate. Spathe large, pure white (Arum Lily) . . . . . *Zantedeschia* (p. 860).
      b. Fem. fl. without staminodes (exc. some *Aglaonema*) :—
        L. often variegated. M. fl. of 2 stamens. Ovary 1- rarely 2-celled, cells with 1 anatropous ovule . *Aglaonema* (p. 860).
        Suffruticose. L. sometimes pinnatifid. M. fl. of 2–6 stamens. Ovary 2-more-celled, several-ovuled . . . . . *Philodendron* (p. 860).

2. Tuberous herbs, rarely caulescent or with thickened rootstocks (some *Alocasia* and *Colocasia*) and then synandrous. Fem. without staminodes. Leaves 1-3 (more in Nos. 9, 10, 12 and 13 or not):—
a. St. free (anther 4-lobed in 7), loculi usually broader than connective. Leaves pedate. Fls. before leaves (exc. 8):—
i. Segments of pedatipartite leaf pinnatifid:—
Spadix inappendiculate. Placentation axile . 5. *Plesmonium*.
Spadix appendiculate. Placentation basal. . 6. *Amorphophallus*.
ii. Leaf segments not pinnatifid. Appendage slender:—
Spathe narrow oblong. Ovary 1-celled, ovules 1–4 basal. Flowers before leaves . 7. *Sauromatum*.
Spathe broad or cymbiform. Ovules 2–8. L. and Fl. cœtaneous . . . . . 8. *Arisæma*.
b. Stamens free or synandrous. Leaves all simple or hastately or sagittately lobed:—
i. Stamens free. Leaves hastate. Flowers cœtaneous:—
Ovules several, basal and apical . . . 9. *Theriophonum*.
Ovules 1–2 basal . . . . . 10. *Typhonium*.
ii. Stamens synandrous. L. sagittate or ovate and cordate, usually peltate:—
† Fls. and leaves not cœtaneous. Spathe broad, yellow. Bulbiferous stolens developed with the leaves . . . . . 11. *Remusatia*.
†† Fls. and leaves cœtaneous. Stolons, if present, not bulbiferous:—
Ovary with parietal placentæ. Ovules many . . . . . 12. *Colocasia*.
Ovary with intruded nearly central placentæ . . . . . *Caladium* (p. 866).
Ovary with basilar placentæ. Ovules few-many . . . . . 13. *Alocasia*.
B. Aquatic herbs, rooting or floating, with linear or lanceolate or small and cuneate-obovate leaves. Ovaries few:—
Rooting in earth. Ovaries in a single basal whorl. L. linear or lanceolate . . . . . 14. *Cryptocoryne*.
Floating. Ovary single basal. L. obovate-cuneate . 15. *Pistia*.

1. POTHOS, *L.*

Herbs or shrubs scandent by means of the adventitious roots. Leaves distichous articulate to the usually winged petiole, simple. Latex tubes and spicule-cells absent. Spadix terminal or axillary, peduncled with small reflexed cymbiform or elongate persistent spathe, sessile or stipitate above the spathe. Tepals 6 with incurved tips. Stamens 6 with flat filaments and ellipsoid anther-cells, extrorse. Ovary 3-celled, stigma small. Ovule 1 in the inner basal angle of each cell, anatropous. Berries 1–3-seeded. Seeds exalbuminous, embryo macropodal.

Leaves 1–4″ long. Spadix ·17–·2″ diam. Spathe ·17–·25″ broad . 1. *scandens*.
Leaves 3–6″. Spadix ·25–·5″ diam. Spathe ·5–·7 ″ broad . . 2. *Cathcartii*.

Pothos aureus, Lind. et André, has been removed to *Scindapsus*.

1. P. scandens, *L.*

Suffruticose, much branched. Leaf-blade elliptic or ovate or oblong, acute or sometimes apiculate, 1–4″ long. Petiole (with the wings) ·25″ by ·1″ to 2·5″ by ·6″, gradually narrower downwards,

upper tips of the wings auricled (in Puri specimens) or obtuse (in Ramnagar specimens). Spathe ·17–·25″ broad, cymbiform, cuspidate, peduncled, and spadix with a pedicel above the spathe which is usually deflexed. Spadix ·17–·2″ diam., ellipsoid or obovoid.

Ramnagar Hills! Puri! Fl. March–April.

There is considerable difference of opinion as to the limitation of the species in this group of *Pothos*. Engler separates *scandens*, *Roxburghii*, *Vriesianus* and *Cathcartii*. *Roxburghii* is separated by the quite globose spadix ·3–·35″ diam. Our Ramnagar specimen with very small leaves resembles one specimen placed in *Roxburghii* but it is not in flower. Other specimens placed in *Roxburghii* in *Herb. Kew.* have the form of leaf of *Cathcartii*. Some botanists make the deflection of the pedicel a specific character.

2. **P. Cathcartii,** *Schott.*

Less widely scandent than the last, but larger in all its parts and leaves acuminate, 3–6″ long, oblong, ovate-oblong or sometimes lanceolate, petiole about half as long as the blade, narrowly obcuneate (with the wings). Spathe ·5–·7″ broad (up to 1″, *F.B.I.*). Spadix ·25–·35″ diam. (up to ·5″ *F.B.I.*). Pedicel erect. Berries scarlet ·5–·7″ long.

Taria and Duars! and probably therefore in Purneah. Fl. c.s.

See note under *P. scandens*. *Hooker* includes under *Cathcartii* plants with quite globose spadices and my plant has such a spadix and according to *Engler*, therefore, should be *P. Roxburghii*. *Hooker* also states that the pedicel or stipes is sometimes decurved in *Cathcartii*.

Species of **Anthurium,** a large tropical American genus, with usually conspicuous caudex and variously shaped reticulately nervuled leaves and frequently brightly coloured spathes are commonly cultivated in grass greenhouses.

2. RHAPHIDOPHORA, *Schott.*

Suffruticose climbers clinging by their adventitious roots, with distichous usually large, entire or pinnatifid leaves with many primary nerves and branching secondary nerves; petiole geniculate at the tip. Spathe coriaceous, ovate, acuminate, deciduous. Spadix sessile above the spathe, stout. Flowers crowded 2-sexual, perianth 0, stamens 4–6 with very short flattened filaments and terminal anthers. Ovary obconic, truncate, with small sessile linear stigma. Ovules many parietal. Berries many-seeded and confluent, their tissue loaded with intercellular raphides. Seeds albuminous. Embryo axile.

Parenchyma of the stems and leaves with raphides.

1. **R. decursiva,** *Schott.*

A stout climbing aroid with stems over 1″ diam., large glossy pinnatifid leaves about 1 ft. long with 4–5 segments, or in more luxuriant specimens up to 2·5 ft. long with 6–12 segments, segments falcate acuminate 3–4-nerved 6–12″ long, paler green but not glaucous beneath. Petiole about as long as blade, terete, slightly grooved but neither deeply channelled nor winged. Spathe 5–7″ subcylindrically cymbiform, yellow, beaked. Spadix shorter than spathe, narrow oblong. Peduncle 3–6″. Stigma raised on the conical top of the ovary.

Mayurbhanj Mts., above 2500 ft.! Fl., Fr. July–Nov.

Closely allied to *Rhaphidophora* and *Scindapsus* is the American genus **Monstera** which includes the often cultivated *Monstera deliciosa*, Liebm. (sometimes called *Philodendron pertusum* by horticulturists). It has very large coriaceous leaves which are not only pinnatifid but curiously perforated with large holes. The very long syncarps are eaten in Mexico.

3. SCINDAPSUS, *Schott.*

Stout climbing aroids with the characters of *Rhaphidophora* but the one-celled ovary has a single basilar ovule and the seed is exalbuminous.

1. **S. officinalis,** *Schott.* Dhare-jhapak, *S.*

A stout epiphytic climber with almost woody stems when old, and large rather fleshy undivided broadly elliptic or ovate leaves 8–10″ by 5–6″ with dilated or winged petiolar sheaths. Spathe 4–6″ green outside, ultimately yellow within terminating in a long acumen, deciduous. Spadix stout, nearly as long and elongating to 6–9″ in fruit, with densely packed prismatic truncate ovaries grooved below, the short 4-celled anthers in the grooves.

Frequent on trees and rocks in the damper valleys of Singbhum! Ranchi (Horhup forest)! Manbhum, *Camp.*! Santal Parg., *Kurz*! Angul! Narsingpur! Fl. June–July. Usually deciduous in the h.s.

When leafless it is easily recognised by the stout green branchlets with white annular scars and the tissues full of raphides. These are also easily seen in the spathe and ovary. Leaves with rounded or cordate base. Petiole (or sheath?) winged up to 6–7″ in length and 1″ or more wide, then a very short unwinged portion (petiole proper?). Peduncle shorter than the sheath. Stigma elongate, hemispheric in fruit.

The fruit is applied by the Santals for rheumatism, *Camp.*

2. **S. aureus** *Engl.* Syn. Pothos aurea, *Lind and André*, is a very common garden plant with leaves more or less ovate and entire, variegated a golden yellow. *Engler* does not appear to have seen the inflorescence which should be looked for.

4. LASIA, *Lour.*

Stout spinous marsh herbs with branched rhizome and long-petioled hastate entire or pedately pinnatifid prickly leaves. Spathe very long, narrow, fleshy, twisted, with convolute base, deciduous. Spadix short, cylindric, flowering downwards. Flowers 2-sexual. Tepals 4–6 obovate with truncate incurved tips. Stamens 4–6 with short flat filaments and parallel extrorse anther-cells. Ovary ovoid 1-celled with stout style and depressed stigma. Ovule 1, pendulous from the top of the cell, anatropous or semi-anatropous. Berries obpyramidal, 6-sided, top warted or muricate. Seed compressed, rugose, exalbuminous. Embryo macropodal.

Vascular bundles of stem and petioles with straight latex-tubes.

1. **L. spinosa,** *Thwaites.* Syn. Dracontium spinosum, *L.*; L. heterophylla, *Schott.*; Kanta-saru, gola-kanta, *K.*, *S.*

A very prickly stout herb with thick rhizome and hastate pinnatifid leaves 6–18″ long with the lower lobes pedate and base cordate, lobes 1-costate acuminate, nerves prickly. Petiole erect prickly 1–4 ft.

long, sheathing towards the base. Peduncle prickly, about as long as the petioles, with a deep purple thick and rather brittle twisted spathe about 1 ft. long. Spadix 1–2″ with densely packed flowers with 4 (in the plants examined) pink imbricate perianth lobes hooded over the stamens. Stigma orange, broad, sessile. Heads of fruits oblong 4–6″ long and 2″ diam., with spongy axis, berries more or less 4-sided, muricate, ·75″ long. Seed large in a coriaceous testa.

Along muddy streams. Singbhum, frequent! Santal Parg.! Sambalpur! Fl., Fr. Dec.–Feb.

The fruit and rhizome are used for sore or swollen throat.

Aglaonema is a genus of succulent or half-shrubby perennials chiefly of tropical India and Malesia with erect or prostrate caudex and ovate or oblong or lanceolate often variegated leaves for which they are often cultivated in grass conservatories, etc. *A. commutatum*, *Schott.* with spotted leaves is one of the commonest.

Dieffenbachia is mostly a genus of large suffruticose herbs or climbers, inhabitants of tropical America and are often grown in pots. from cuttings which very easily strike root. The leaves are usually large oblong or ovate and copiously variegated. Many varieties are in cultivation, *D. seguine*, *Schott*, var. *variegata*, being the commonest. It is native of West Indies.

Philodendron is a large American genus containing some extremely handsome aroids with large leathery leaves, natives of tropical America. Some are almost tree-like, others climbing; the leaves are often cut or perforated. *Ph. bipinnatifidum*, *Schott*, has a stem over 6 ft. high and very large 2-pinnatifid leaves. Other species have beautifully coloured spathes.

Zantedeschia æthiopica, *Spreng.* is the name given in *Nat. Pflanz. Fam.* to the well-known Lily-of-the-Nile (*Calla æthiopica*, *L.* or *Richardia africana*, *Kunth*) which is really a South African plant. It only grows in cultivation in the cooler parts of the province.

5. PLESMONIUM, *Schott.*

Herbs with bulb-like tubers and 1–few 3-foliolate or -partite and pinnatisect leaves appearing after flowering. Spathe ovate, convolute below, marcescent. Spadix included or exserted, free, bearing female flowers for about one-fourth way up, then densely packed clavate disciform or truncate neuters, the upper half being occupied with male flowers, spadix not produced beyond the flowers.* Male fl. of naked sessile almost quadrate anthers with the cells immersed in the connective and opening at the top by short curved pores. Female fl. of single ovaries slightly sunk in the spadix, with very large capitate stigma. Ovary 2–3-celled. Ovule 1 on the central placenta. Berry oval, 2–3-celled and -seeded. Seeds ellipsoid, exalbuminous.

Unbranched latex tubes occur in the vascular bundles of stem and petiole.

* I have however an abnormal specimen from Central Provinces in which there is an appendix.

1. **P. margaritiferum,** *Schott.* Had, *K.*

Tuber large depressed hemispherical about 3″ diam. Leaf solitary, rarely 2, 1–2 ft. high and 12–18″ diam. digitately 3-foliolate, lateral lflts. again 2-partite and then pinnatifid into narrowly lanceolate sometimes forked acuminate segments with strong midrib and oblique sec. n. joined by one or two intra-marginal nerves. Scape 15 in. to 2 ft. high preceding the leaves, brown-streaked and clouded below. Spathe broadly ovoid or deltoid when unfolded (artificially), green and leathery, deep purple at base within and often flushed purple above, obtuse, 3·5–4·5″ long. Spadix exserted, 4·5–6″ long, erect, with a stipes above the spathe for about ·5″ long, the females then occupying the next ·75–1″.

Common. Very common in the open forest land at Purneah, *Burkill* (see below). Singbhum! Ranchi! Manbhum, *Camp*! Fl. May-June. Leaves do not appear until the rains are well set in.

"Had" in Kol merely means *acrid*, but the tubers are said to be eaten after much cooking. The neuter flowers are large white and clavate up to ·3–·35″ long in some specimens, or yellow and disciform in others, but the form on the same individual is variable; they are very frequently eaten up by insects.

The Purneah plant is named *Plesmonium Burkillii* by *Engler* and *Kraus*. The leaf is 3-sect. with each segment 12–15″ long 2-chotomously branched and cut into linear somewhat tapering lobes 3–5″ long. The infrutescence stands taller than the leaves. Berries red. It is difficult to say where it differs from forms of *P. margaritiferum* except that the leaf is larger than usual.

6. AMORPHOPHALLUS, *Blume.*

Herbs with bulb-like tubers and 1–few large 3-foliolate or 3-partite and pinnatisect leaves appearing after flowering. Spathe campanulate, infundibular, convolute or open, marcescent. Spadix included or exserted, free, bearing dense male flowers and female flowers without the interposition of neuters, spadix always produced above the flowers into a large, short or long appendage. M. fl. with 2–4 naked sessile anthers with oblong cells and apical pores. Fem. fl. of globose or obovoid 1–4-celled ovaries with short or long styled and entire or 2–4-lobed stigma. Ovule solitary subbasilar, anatropous. Berries subglobose or obovoid. Seeds exalbuminous. Embryo macropodal.

Unbranched latex tubes occur in the vascular bundles of stem and petiole.

Petiole rough with small tubercles. Spathe broad campanulate, open, appendage short sinuous. Peduncle very short . . 1. *campanulatus.*
Petiole smooth. Spathe with ovate cymbiform limb, appendage short conoid or oblong rounded. Peduncle elongate . . 2. *bulbifer.*

1. **A. campanulatus,** *Blume.* Ol, *H.*, *K.*; Olna, *Or.*

A very stout herb with the single (rarely two) leaf 1–3 ft. broad, 3-partite with the lateral segments 2-furcate, pinnatifid with oblong lobes or leaflets 4–8″ long; petiole 1–3 ft. long mottled dark and light green, very stout, rough with small tubercles. Peduncle much shorter than the spathe, elongating in fruit to 5–6″. Spathe with a campanulate tube suddenly widening into an irregular spreading plicate and undulate recurved limb 6–10″ broad coloured greenish and purple and often blotched below with white. Spadix very stout. Female portion about 3″ long by 2·5″ diam. with crowded depressed-

globose sessile ovaries, styles ·5″ long purple. Male inflorescence subturbinate about 3″ long by 1–2″ diam. with pale-yellow anthers. Appendage dark purple rather shapeless or somewhat conoid, sinuately lobed very large. Fruiting spikes 3–4″ long with red obovoid berries ·5″ long, 2–3-seeded.

Very common, Chota Nagpur! Cuttack! and probably throughout the province but apparently always near villages. Often cultivated and doubtfully indigenous. Bandgaon (Ranchi) *Clarke*, wild? Fl. April–June. Fr. Nov.

Tuber depressed hemispherical 6–10″ diam.

Prain distinguishes a variety **Blumei** (*Beng. Pl.*, p. 1109) with large depressed globose hardly warted tubers and appendage subregularly pyramidal which he states is cultivated only and is known as the Bombay Ol, whereas the type is said to have usually much warted tubers and the appendage irregularly amorphous. He believes this to be wild and cultivated in all the provinces (*i. e.* as distinguished in *Beng. Pl.*).

The cultivated tuber is eaten.

2. **A. bulbifer,** *Blume.* Amla-bela, *Beng.* (*fide Roxburgh*).

A somewhat less stout plant than *A. campanulatus*, the leaf usually less broad and the leaflets obovate or lanceolate, it usually bears when mature a large bulbil above the petiole at the forks of the leaf by which it is easily recognised. Petiole as long as in *campanulatus*, green and pink mottled with black, smooth. Peduncle 6–10″, mottled. Spathe 3–4″ long broadly tubular with ovate (when unrolled) cymbiform obtuse limb open at the top, of a beautiful lively pink or flesh colour deepening to scarlet inside the tube and outside faintly mottled greenish pink. Spadix 3–3·5″ long, female portion scarlet ·5″ long, style very short or 0, 2–4-lobed stigma pink, ovule usually 1 only the other usually abortive. Male inflorescence 1–1·25″. Appendix rather stout pale flesh-coloured 1·5–4″ long.

A very common forest species in Chota Nagpur! and probably in all districts. Fl. May–July.

The dimensions appear rather variable. *Roxburgh* states that near Calcutta the leaf attains 4 ft. diam. A specimen collected near the Tista River (Darjeeling District) had peduncles 7–8″, spathes 7″ by 2·3″ and spadix 5″.

No use appears to be made of the plant.

7. SAUROMATUM, *Schott.*

Tuberous herbs with large solitary (rarely 2) pedatipartite leaves with broad leaflets, appearing after flowering. Spathe shortly peduncled with short cylindric base with connate margins and very long narrow open finally reflexed limb. Spadix sessile nearly as long as the spathe, male and female inflorescence widely distant, short, dense flowered, with a few large clavate scattered neuters close above the female, appendage slender not sharply differentiated at its base (as in *Typhonium*). Stamens with compressed connective, cells 2–4 with oval pores. Ovary oblong 1-celled, with 1–4 basal orthotropous ovules, stigma sessile. Berries obpyramidal, 1–2-seeded (1-seeded, *F. B I.*). Albumen fleshy. Embryo axile, straight, terete.

Vascular bundles with unbranched latex-tubes in stem and petiole.

1. **S. guttatum,** *Schott.*

Tuber flattened-globose or hemispheric 2·5″ diam. Leaves occasionally 2, very variable in size, often 2·5 ft. diam. in luxuriant

specimens with a petiole 2 ft. long and nearly 1″ diam. at its base arising from the centre of the tuber. Peduncle arising from one side of the tuber only 1–2″ long in flower, 2–3″ long in fruit, green and spotted. Spathe 7–20″ long, tubular portion not much differentiated from the limb and often more or less open (at intervals) down to the neuter inflorescence which is soon crowded with dead flies, limb linear-lanceolate, leathery, greenish or yellowish with purple blotches, margins usually purple, waved, apex with a short cusp. Spadix rather slender, ovaries occupying about ·5″ at base with clavate neuters just above, then a smooth purple space for 1·5″ above which is the male inflor. only ·5″ long with a smooth grey or purple terete appendix above.

Chota Nagpur jungles, 2000 ft., common!

Central leaflet broadly-elliptic or obovate, rarely narrow-ell. or ell.-oblong, lateral lflts. 2–5 each side not cut quite to the rhachis except the last and smallest of the pedate system which is sometimes shortly petioluled and only 3–5″ long, others with very broad base and shortly acuminate tip, shining and glabrous both sides, paler beneath, sec. n. translucent very numerous uniting in an intra-marginal one from which again nervules radiate and again unite in a second intramarginal nerve; some of the sec. n. are forked or form a few large areoles by intermediate nerves. Fruiting head 1·5–2·5″ diam. subglobose with globose or clavate white receptacle. Berries reddish of more or less hexagonal prisms ·4″ long, flattened above with a round stigmatic star. Seeds 1–2 (with the remains sometimes of 1–2 other ovules), basal, yellow, pyriform, sub-stipitate.

8. ARISÆMA, *Mart.*

Tuberous herbs with 1–2 leaves 3-sect or pedatisect or pedately compound or with whorled leaflets. Spathe coætaneous deciduous, convolute at base, with the limb variously shaped often very broad, usually incurved at the tip. Spadix included or exserted, appendage various, sometimes with a disc-like swelling at base, often excessively long and filiform. Flowers usually diœcious. Fem. fl. densely crowded at the base with sometimes a few neuters above them, ovary 1-celled with short or 0 style and disciform stigma. Ovules 2–8 basilar, orthotropous. Male inflorescence of sessile or stipitate synandria each of 2–5 stamens with cells opening by pores or slits, sometimes neuters above them and neuters sometimes continued on to the appendage. Berries 1–few-seeded. Seeds albuminous with axile embryo.

A very interesting genus of very numerous species, chiefly Himalayan. The appendage sometimes ends in a filiform thread several feet long, trailing on the ground or caught up on other plants. I have found no explanation of this curious development.

Vascular bundles have latex-tubes.

1. **A. tortuosum,** *Schott.* Dain, *Kharw.*; Tuya-jondra, *S.*

About 3 ft. high with a handsome marbled stem and usually 2 leaves with the central leaflet distinct and often shortly petioluled and the 4 lateral on each side pedatisect or pedate with very short petiolule, leaflets lanceolate or oblanceolate and acuminate, centre one 7–9″ by 1·5–2″ lateral nearly as large or gradually smaller. Spathe 3–5″ on a peduncle 2–4 ft. long broadly cymbiform above the open tube, incurved, acuminate, green. Spadix 1- or 2-sexual with yellow

slender appendage which is decurved and then again upcurved and exserted, slender and quite smooth.

On the Ranchi plateau and ghats, Horhap forest, etc.! Palamau, Ramandag Forest! Parasnath, *Clarke*! Fl. May–June. Fr. Nov. Withering away in Dec. Tuber depressed globose 2–3″ diam. Leaflets usually 9 in our plant, narrowed into sessile or petiolulate base, sec. n. numerous, oblique, uniting in an intramarginal nerve. Peduncle embraced by the leaf sheaths for a considerable distance. When monœcious the stamens occupy the upper two-thirds of the inflorescence without intermediate neuters, synandria stipitate of 3–4 anthers. Fruiting head about 2″ long, ovoid with oblong red berries ·4″ long, each with 3–5 grey subglobose angular seeds ·15″ diam. with short stout obconic base. Apparently the same plant ascends to 8000 ft. in the Himalayas.

9. THERIOPHONUM, *Blume.*

Tuberous herbs with cordate or sagittate or hastately 3-lobed leaves. Spathe scarcely constricted, limb ovate-oblong lanceolate or linear. Spadix included, often very slender, female at or a little above the base, ovaries sometimes very few, 1-celled, with sessile rounded stigma. Ovules orthotropous few, erect basal and also pendulous from the apex of the ovary. Neuters above the females or not, and below the males, subulate or filiform. Male inflorescence several times longer than the female with sessile didymous synandria of 2 stamens opening by slits or pores, appendage elongate sometimes very slender smooth at least above, sometimes muricate at the slender base with staminodes or neuters. Berries ovoid.

Latex-tubes occur in vascular bundles of stem and petioles.

1. **T. minutum,** *Engl.* var. **Chattarjeei,** *Haines*; Inc. T. Zeylanicum, Kleinii, crenatum and Wightii.

Whole plant about 8–12″ high with hastately or sagittately 3-lobed leaves 3–5″ long by 1·5–4″ broad, basal lobes lanceolate or ovate-lanceolate. Petioles 4–7″ long. Peduncle ·5–1″. Spathe linear or linear-lanceolate 3″ by ·5″, erect finely acuminate. Spadix 2–2·5″, slender. Ovaries in a single whorl at the base, oblong, ·08″ long with 3–4 minute ovules top and bottom. Male inflorescence ·5″ long with few filiform neuters at its base ·15–·2″ long, anthers minute didymous, connective with a few minute papillæ at apex. Appendage about 1·5″ slender, with a slender stipes which is muricate with staminodes or neuters.

Angul, *Chattarjee*! Fl. Aug.

Two specimens were sent to me by *Mr. B. K. Chattarjee* who stated that it was common. Those botanists who would separate *zeylanicum*, N. E. Br., *Wightii*, Schott, etc., would also have to make *this* a *separate species* differing from either of *Engler's* sections (*Eutheriophorum* and *Calyptrocoryne*) but uniting them both, the anther-connective not being at all produced, but the rudimentary flowers being much closer to the male inflorescence than to the female. Th. Wightii, *Schott* (regarded by me as merely another variety of one widely variable species) with large spathes and very long appendaged anthers has been collected in Raipur close to our area. *Engler* himself says of this species "verisimiliter etiam haec species, cujus specimina pauca tantum vidi, cum priore conjugenda erit, si specimina numerosa comparari possunt." Of the species enumerated by *Engler* our plant comes closest to *Th. zeylanium*, some of which (omitting the anther appendage) exactly match it.

10. TYPHONIUM, *Schott.*

Herbs with usually depressed globose tubers and entire sagittate or 3–5-lobed or pedately divided leaves. Spathe appearing with the

leaves, with short convolute persistent tube and constricted between the tube and the deciduous ovate-oblong lanceolate or linear limb. Spadix exserted, male and female infl. distant with neuters above the female and sometimes below the male, appendage elongate muricate or smooth. Synandria of 1–2 subsessile anthers, opening by pores or short slits. Ovaries 1-celled formed of one carpel, stigma sessile, placenta basal with 1–2 erect orthotropous ovules. Berries ovoid. Seeds 1–2, globose, albuminous, with axile embryo.

Latex-tubes occur in the vascular bundles of stem and petioles.

Some species of *Typhonium* very closely resemble species of *Therophonium* in general appearance.

1. T. trilobatum, *Schott.* Syn. T. orixense, *Roxb.* ? (see below).

Height 12–20″ with a subglobose tuber and hastately 3-lobed or sub-3-partite leaves 5–8″ long and as broad with ovate acute lobes. Spathe 3–8″ long, green or inside red-purple with broadly ovate open limb narrowed to a long point. Neuter flowers above the female many long filiform and curved, appendage bright red stipitate and muricate, base expanded and intruded. Peduncle 1–4″.

Singbhum, in jungles, common! Fl. April–May and Aug.–Sept.

Corm white ·7″ diam. Leaves with the basal lobes sometimes again lobed or auricled making a double sinus at the base and whole blade sometimes broader than long, 4″ by 5·5″ to 8″ by 10″, lobes broadly ovate. Spathe with objectionable odour, mostly 4·5–6″ long (including tube ·8–1″ long), slenderly acuminate, tip straight or twisted, striate. Neuters white, ·7″ long, much curved, twisted, clustered at base, anthers of 2–4 whitish cells with rose-coloured pollen (*Clarke*), barren portion above stamens smooth pinkish and club of appendix dark purple. Fruiting spadix 1·5″ ovoid.

Clarke says that *T. orixense* is distinct, the neuters have long curling thread-like white terminations while in *trilobatum* they are short, oblong, yellow recurved with hardly visible white points. He says also that the leaves differ in venation and spathes also differ. As he knew both in the field and *Roxburgh* also discriminated them he is probably correct.

11. REMUSATIA, *Schott.*

Herbs with a depressed hemispheric bulb-like tuber and erect shoot: from the side of the tuber or corm develops stolon-like bulbiferous shoots with peculiar small crinite bulbils. Leaves peltate, ovate and cordate, solitary in our species. Spathe with an elongate accrescent tube and a broad erect or refracted yellow deciduous limb. Spadix very short, sessile, male and female inflor. separated by neuters, appendage 0. Male synandria densely packed of 2–3 stamens with oblong cells opening by a pore, flat-topped, mixed with neuters. Fem. inflor. short, ovaries with 2–4 parietal placentæ and almost orthotropous ovules, stigma sessile, disciform. Berries obovoid, small. Seeds albuminous, embryo axile.

Branched latex-tubes occur in stems and petioles.

1. R. vivipara, *Schott.*

Corm about 1″ diam. Leaf solitary (though on young plants from bulbils a succession of leaves arise the same season), 8″ by 5″ to 17″ by 12″, dark smooth shining green, ovate acuminate, not very deeply cordate, sinus not extending half-way to petiole, nerves from mid-rib 4–5 each side and from the basal costæ 2–3. Bulbiferous shoots at

first stolon-like, ultimately erect or inclined and bearing clusters of scaly bulbils, scales with hooked awns. Spathe developing before the regular leaf from a broad oblong sheath, tubular portion about 1·3″ and broad golden-yellow limb about 2″, refracted. Spadix 1–1·5″.

Always found by me in pockets of soil among large rocks. Elev. 2000–4000 ft. Singbhum! Ranchi, on the ghats, frequent! Hazaribagh, on Parasnath, *Clarke*! Fl. April. The leaves and bulbiferous shoots develop from the break of the rains and last at least until October.

It can be distinguished from the small rock form of *Colocasia* when without the stolons by the leaves being polished below as well as above, the nervules less clearly defined (when fresh) and the tip acuminate. But when dry the more succulent leaves appear *very membranous* and the sec. nerves very distinct. Midrib with 3–4 sec. n. each side nearly reaching margin and also a pair of sec. n. from junction of basal nerves which bear about 2 other sec. n. There is no intramarginal nerve but a very fine marginal one almost touching the pronounced hyaline margin.

Caladium is a genus of tropical South American aroids with depressed spherical or hemispherical corms and peltate sagittate radical leaves. Both male and female flowers densely packed. Spadix without appendage, dorsally adnate at the base to the spathe. Differs especially from *Colocasia* by the ovaries, which are slightly adherent by their apices, having deeply intruded placentæ so that the ovary becomes nearly or quite 2–3-locular with central placentation. The leaves are often most beautifully and delicately variegated especially when they first appear in the hot season and for this reason are favourite verandah plants.

12. COLOCASIA, *L.*

Shoot from a bulb-like tuber or usually from a subterranean rhizome, more rarely with a rhizome continued into a short erect caudex. Leaves entire, peltately attached to the stout petiole, ovate and cordate or sagittate. Spathe appearing with the leaves with a thick accrescent tubular base above which it is contracted, then with an erect cymbiform limb. Spadix free, shorter than the spathe, stout or slender, male and female inflorescence usually with interposed flat neuters. Appendage cylindric subulate or 0. Synandria obpyramidal, of 3–6 stamens with linear cells which open by a short slit. Ovaries ovoid or oblong, 1-celled, with 2–4 parietal placentæ each with numerous orthotropous ovules, stigma flat 3–5-rayed. Berry many-seeded. Seeds with fleshy outer and a ribbed inner coat, albuminous. Embryo axile.

Branched latex-tubes occur in stem and petioles.

No neuters at base of females, many flat neuters above. Appendix much shorter than inflorescence, rarely 0. Stigma discoid . . . . . 1. *antiquorum.*

Few neuters at base of inflor., very few neuters between M. and Fem. inflor. Appendix slender, longer than the inflor. Stigma oblong . . . . . 2. *fallax.*

1. **C. antiquorum,** *Schott.* Syn. Arum colocasia, *Willd.*; A. nymphæifolium, *Roxb.*; A. esculentum, *L.*; Pichigi, Saru, *K.*; Kachhu, *Beng.*

Stem above ground 0, or slightly swollen at the base of the leaf-sheaths, arising from a hard tapering rhizome or in cultivated varieties

a tuberous rhizome, suckers or stolons sometimes present. Leaves mostly over 12″ (exc. var. *rupicola*), peltate, with triangular sinus cut one-third to half-way to petiole, ovate or subtriangular in outline, with a dull (not polished) surface above, paler or coloured beneath but rarely very glaucous. Spathe peduncled, yellow, mostly over 10″ long convolute, never widely open, curved slightly backwards in flower. Spadix much shorter than the spathe, rather slender, appendix much shorter (exc. var. *rupicola*) than the inflorescence. Stigma discoid.

Common, both wild and cultivated. Fl. June-Oct.

The following varieties and probably others occur in our area :—

Var. α. **typica.** According to *Engler* this has the appendix equal in length to the male inflorescence. Widely cultivated! Ranchi, *Prain*! The next is nearly typical.

Var. β. **esculenta**, *Schott*. Pichgi saru, *K.*

Tubers small. Stolons 0. Leaves commonly about 20″ by 12·5″, the two sides often not quite symmetrical, rather dark green above, beneath paler, scarcely glaucous, tip with very small cusp, sec. n. from mid-rib including one from petiole 6 each side and from the outer side of the basal nerves 3 to each nerve, no secondaries towards the sinus. Petiole as long as blade purplish below. Spathe pale yellow, 11–13″ long with green cylindrical tube 2–2·5″ long. Spadix 5·5–8·2″ long, ·4–·5″ diam. at base; fem. inflor. 1–2″ long, fertile ovaries green but with several barren white ones intermixed; above females are flattened rhomboid or irregularly oblong neuters which often develop a median longitudinal depression or slit. Male inflorescence cylindric 2–3″ long, anthers oblong, with stellately crenate or deeply lobed truncate top, anther-cells 6–8, top flat lobed, lobes as many as the cells, each lobe denticulate and much broader than the cell. Appendage 1·5–2·8″, always shorter than the male inflor. ("half the male," *Schott*).

Cultivated in Chota Nagpur! Fl. Aug.–Oct.

Var. γ. **illustris**, *Engler?*

Leaves deep purple beneath. Banks of streams, Saranda Forests! I have no other notes of this variety, nor specimens. According to *Engler* var. *illustris* has violaceous petiole, blade more oblong-ovate than in type, marked by large purple patches between the primary nerves. I have also a record of a *Colocasia* with violet-black petioles along rivers in Purneah!

Var. δ **stolonifera**, *Haines*, near var. **aquatilis**, *Hassk* (a Javan plant with coloured striate stolons and cataphyllaries).

Stout, stem slightly swollen at base with fleshy rootlets arising from a hard tapering rhizome 4–8″ long by ·7–1″ diam., connected with stem by a neck. Stolons numerous up to 10 ft. in length, ·3″ diam. with narrowly lanceolate half-patent leaf-sheaths with a long slender terete hooked tip, giving rise to new plants at end only. Leaves sagittate from 13″ by 6·5″ up to 20″ by 10″, widest a little below the middle, dark green with shades of darker green above, pale beneath somewhat glaucous, apex with a very small cusp, sec. n. including one from the petiole 5 each side of midrib and those of basal costæ 2–4 on outer side, 0 or 1 on inner side. Petiole 2 ft.–2·5 ft. long. Peduncle from sheath of last leaf about half as long as petiole. Spathe bright deep yellow 13″ long, tube green 2″ long, limb open at top and base for about 2″ each end then convolute. Spadix 4·3″ by ·4″ diam. at base. Fem. inflor. green with some white barren ones among them. 1–1·2″ long, then flat irregularly oblong neuters ·8″, male inflor. 2·2″, appendage 1·2″. Ovules over 40. Anthers oblong, cells 8, top merely crenate (not lobed as in *esculenta*).

Var. ε. **rupicola**, *Haines*. Syn. C. affinis, *Schott*?; var. Fontanesii, *Schott*?

A very much smaller plant in all its parts. Rhizome globose-oblong scaly ·7–1″. Leaves oblong-ovate shortly cuspidate, 4–8″ long on petioles 2–3-times as long; sec. n. including 2 from the petiole insertion, 4 each side only and basal primaries with 2 each. Spathe 5·5–6″ on peduncle 4·5″, tubular green portion 1·5″, limb yellow. Spadix 4–4·5″. Females perfect for ·5″ then tapering and spadix bearing barren females and rhomboid flat neuters for 1″, male inflor. 1″ long, anther-tops with 4–6 crenulate lobes. Appendix about 1·5″ or rather longer than the male inflor.

Among rocks. Ranchi and Singbhum! Fl. Oct. Only differing from *affinis*.

Schott, in the rather shorter appendix. Rajmahal Hills, *Kurz*! This specimen is called var. *Fontanesii* by *Engler*, but there are only leaves, and these do not correspond to *Schott's* description of *Fontanesii*, which moreover was a Ceylon plant!

2. C. fallax, *Schott.*

A very glaucous plant 12–18″ high with stolons 12–24″ long by ·15–·17″ diam. freely rooting at the nodes. Leaves ovate or elliptic-ovate obtuse or subacute and with a very small cusp, 7·5–13″ by 5–8·25″, base rounded with a shallow rounded sinus, beautifully glaucous beneath. Petiole longer than the blade, tapering to the point of attachment where it is very slender. Spathe quite erect, 5–6″; tube green ·7–1″ rather suddenly contracted to the yellow very finely acuminate limb. Spadix 4·5–5″, slender with a few white clavate neuters shortly above the base longer than the ovaries. Fem. inflor. pale yellow ·6–·8″ long, ovary with oblong stigmas, flattened neuters above females very few and only occupying ·1–·2″. Male inflorescence ·8″ long, anthers oblong, slightly compressed with the flat top crenulate, the crenules corresponding to the 8–9 cells, slit of apical pores extending to margin. Appendage brown 3″, tapering from base upwards, smooth except near base where somewhat rugose with undeveloped neuters.

Singbhum, Ranchi and Palamau on the pats, elev. 3000 ft.! Fl. Aug.

I at first described this as a separate species as it differs from the descriptions of *C. fallax* and also from some of the specimens, but it exactly agrees with a specimen named *fallax* by *Mr. N. E. Brown* which was grown in the Kew Gardens (origin unknown).

L. with 5–6 nerves each side of midrib including one from the insertion of petiole or very close to it, basal primary nerves sometimes forked and with 3 sec. n. on the outer side of each primary. Sheaths on stolons inconspicuous, scarious, venose, appressed, ovate and shortly cuspidate. Ovaries ovoid, gland-dotted and marked with 3 carpellary lines, walls very thin. Ovules numerous on mucilaginous parietal placentæ.

Engler (in *Pflanzenreich*) describes the style as "*brevi coronata*" but it is distinctly oblong stigmatic in my specimens. *Schott* (in *Bonplandia*, vii, 28) says "ovaria stylo brevi sed manifesta prædita" but the type (Bir-pance, Terya Ghat, Khasia Hills, *H.f.*) is in fruit. Some other specimens show when dry an oblong style (or stigma) often surrounded at base by a small annulus.

13. ALOCASIA, *Schott.*

Stem usually rhizomatous but sometimes rises a considerable distance above the ground. Leaves usually very large entire, peltately attached or not to the long petiole, more or less ovate and cordate or sagittate. Spathe appearing with the leaves with a thick persistent accrescent tubular base above which it is contracted, then with an erect cymbiform limb. Spadix free somewhat shorter than the spathe with a short female inflorescence without staminodes, above the female inflorescence usually flat neuters and then the male inflorescence of free obpyramidal hexagonal synandria each of 3–5 stamens. Appendage cylindric subulate or 0. Ovaries ovoid, 1-celled, with few to many basilar orthotropous ovules, stigma 2–4-lobed. Fruit enclosed by the accrescent tube of spathe which becomes lacerate, berry almost spherical, red, few-seeded. Seeds albuminous, roundish, with thick smooth testa and axile embryo.

Branched latex-tubes occur in stem and leaves.

I have taken most of the characters of the species from *Engler* and *Roxburgh*, the available specimens being few and usually very poor.

I. Not caulescent. Lowest secondary nerves not uniting with the primaries of the basal lobes :—
Spathe about 5″, coloured. Spadix nearly as long . . 1. *montanum*.

II. Caulescent. Lowest lateral nerves joining the primaries of the basal lobes and almost reaching the apex :—
A. Basal lobes semiovate or ovate, rounded :—
1. Basal lobes free to the base or nearly so :—
Terminal lobe broader than long. Spathe 6–10″ cymbiform. Appendix longer than inflorescence . . 2. *macrorrhiza*.
Terminal lobe ovate-triangular longer than broad. Spathe narrowly cymbiform 8–12″ with disagreeable smell, appendix longer than inflorescence . . . 3. *indica*.
2. Basal lobes more or less connate at base :—
Spathe cymbiform, fragrant, 5-8″ long . . . . *odora* (pp. 869, 870).
B. Basal lobes triangular subobtuse or subacute, connate at base. Spathe 3–4″ . . . . . 4. *fornicata*.

1. **A. montana**, *Schott*. Syn. Arum montanum, *Roxb.*

Caudex a short cylindrical tuber up to 2″ diam. Leaves somewhat coriaceous broadly cordate-ovate, polished, 6–8″ long and nearly 6″ broad, shortly apiculate at the obtuse apex, basal lobes only about one-fourth as long as the broadly ovate terminal lobe with an almost circular sinus between, secondary nerves 3 on each side almost from the base, 4–5 sec. n. higher up ascending within the margin and uniting in an intra-marginal nerve. Petiole stout 8–10″. Peduncles several, about 8″ long. Spathe cucullate, coloured (*Roxb.*, yellow ?) with oblong tube 1–1·2″ and limb nearly 4″, acute. Spadix nearly as long, neuter inflorescence rather suddenly thickened at the base, conoid, acute towards the apex and 2–2·5″ long.

Found by *Roxburgh* in the mountains of the Northern Circars and very likely occurring in the mountains of Puri and Mayurbhanj.

The root is said to be used to poison tigers. *Roxb.*

2. **A. macrorrhiza**, *Schott*. Syn. *A. odora*, *C. Koch* ; Arum odorum, *Roxb.*

The largest of our terrestrial aroids, forming a considerable aërial stem often 4 ft. high (attains a much greater size in some provinces) and 2–4″ diam. more or less clothed with aërial roots. Leaves broadly ovate-sagittate repand, 2–4 ft. long and 1·5–3 ft. broad, deeply cordate, with the basal lobes shortly connate or for about one-tenth of their length and sinus narrow. Spathe 6–10″ long with the tube about half as long as the coriaceous hooded cymbiform cuspidate pale-green limb. Spadix nearly as long as spathe and appendage nearly as long as the flowering part, sinuously sulcate. Ovary incompletely 4-celled.

Often seen near pools and rubbish heaps in the moister districts close to the villages but not indigenous. Fl. c.s. Fr. h.s.

The flowers are said to be fragrant.

Engler maintains the distinctness of *odora* and *macrorrhiza* in which case our plant is probably *odora*. In addition to the key characters (see above) which are based on his own but are unsatisfactory (as he states that specimens of *odora* may be found with basal lobes little or scarcely connate), the following appear to be the points of difference and are mainly in relative size :—

A. macrorrhiza.

Caudex 6–15 ft. high and up to 8–12″ diam. L. up to 2 ft. and as broad, end lobe triangular ovate acute with 9–12 lateral nerves each side, the lower digitately spreading. Petiole and costæ sometimes coloured. Peduncles 5–8″ long. Tube of spathe oblong 2·5–3·3″ long, limb 4·7–6·5″ long by 2–2·5″ broad in middle. Fertile male inflor. 2–2·5″ long, sterile appendix conoid obtuse or subacute sulcate 2–2·5″ long.

Native of Ceylon.

A. odora.

Caudex only 2–3 ft. high and up to 2–3·5″ diam. L. 20″–3 ft. long by 15–30″ broad, end lobe broadly ovate, acuminate, with 6–10 lateral nerves each side; basal lobes semi-ovate rounded at tip. Peduncles 5–9 5″ long. Tube of spathe oblong-ovoid or ovoid 1·3–1·7″ long, limb 4–5·5″ long, 1·7–2·1″ broad. Fertile male inflor. 1·25″ long. Sterile appendix narrowly conoid 1·25–1·5″ long, thickened at base and ·4″ broad, attenuate upwards.

Native of tropical Himalaya, Silhet and Khasia Hills.

3. **A. indica,** *Schott.* Manna, Man-kandu, *H.*; Man-guri, Man-kachu, *Beng.*

A robust herb with caudex attaining 3–6 ft. and 4–8″ diam. Leaves 2–3 ft. long bright green, triangular-sagittate slightly repand, end lobe triangular acute (*Roxburgh* says rounded with a bent-down dagger-shaped point), with strongly marked whitish midrib and 6–8 strong pale sec. n. each side spreading at an angle of 60–70° from the midrib and slightly ascending towards the margin; basal lobes ovate with rather a narrow sinus between and sometimes shortly confluent, their primary nerves forming an acute or nearly a right angle with each other. Petiole as long as or longer than the leaves, round and tapering upwards, sometimes transversely clouded. Peduncles several (always paired, *Roxb.*) 4–8″ long. Spathes with slight, rather offensive smell, 8–12″ long, of a pale greenish-yellow inside and out, tube oblong-ovoid 1·5–2″ long (marked inside with irregular reddish lines, *Engler*), limb 6–9″ long by 2–2·4″ broad, narrowly oblong with a small subulate cusp. Fem. inflor. yellow, narrowly ovoid, about 1″ long; fertile male inflor. white 1·5–2″ long, appendix conoid rugulose 4–5″ long and ·3–·4″ broad. Pistil obovoid about ·2″ long with sessile 3–4-lobed stigma. Berry red ·3–·4″ diam.

Occasionally cultivated near native houses. Purneah! Chota Nagpur, *Wood*! Some varieties cultivated as ornamental plants! Fl. April–May.

Numerous fibres from the rootstock end in small tubers and the caudex is usually furnished with adventitious roots.

The stems and small tubers referred to above are eaten.

There are several varieties. *Man-guri* has the petiole darker coloured. In the garden variety *variegata* the petiole has irregular violet lines and the blade is glaucous beneath with pallid nerves, deep green above. Young plants resemble those of *A. odora.*

4. **A. fornicata,** *Schott.*

A rather large aroid with stout erect caudex 6″ to 2 ft. high above ground. Leaves polished ovate sagittate 12–15″ (whole length, only 8–10″ from insertion of petiole to apex) by 6″ to 18″ by 10″ or even larger, basal lobes about half as long as terminal lobe or less, connate for one-tenth (in Orissa specimens) to one-third (in Chota Nagpur specimens) their length. Petiole 18″ to 3 ft. long. Spathe about 3·5″ only with tubular green base about 1″ only in flower and a whitish-

green or greenish-yellow oblong cuspidate limb 2·5″. Spadix about equalling the spathe with the appendage about as long as the inflorescence. Synandrium with flat crenulate top and several cells opening by pores above. Ovules 3–5 basal, style short stout, stigma capitate 3–4-lobed. Fruiting peduncle 6–10″ somewhat clavate upwards.

Not common. Always under shade and usually along muddy streams. Chota Nagpur (chiefly Singbhum Forests)! Puri forests! No specimens from our area in *Herb. Cal.* Fl. June–July. Fr. Sept.

Basal primary nerves almost at right angles, sec. n. to midrib 5–8 each side slightly raised above and about 4 on upper side only of each basal nerve, tertiaries rather faint uniting in an intermediate nerve. Petiole and peduncle sometimes with black markings. Fruiting spadix 1″, inside accrescent spathe base 1·75–2·5″ long. Berries ·15″ diam. globosely obovate crowned with the short style, with one erect seed and 3–4 abortive ovules.

14. CRYPTOCORYNE, *Fisch.*

Aquatic or marsh herbs with creeping rootstock and stem short or 0. Leaves simple, narrow or broad, sometimes almost grass-like. Tube of the spathe subterranean or submerged and almost completely closed against the entry of the water by ingrowths or partial septa, limb often narrow, projecting above the water by means of which pollinating insects have access.* Spadix very slender with its tip adhering to the septum in the spathe. Fem. infl. a single whorl of connate 1-celled ovaries with a few pistillodes or neuters. Male infl. cylindric with 2-celled anthers, cells with conical perforate tips and vermiform pollen. Ovary with short recurved styles and many erect orthotropous ovules. Fruit of coriaceous connate 2-valved many-seeded carpels. Seeds oblong, albuminous with axile embryo.

A. Tube of spathe above the inflorescence long and slender :—
  Spathe reticulate inside opposite the male inflorescence . 1. *retrospiralis.*
B. Tube of spathe above inflorescence 0 or split :—
  Spathe transversely lamellate or rugose within. Peduncle 0 2. *spiralis.*
  Spathe smooth within. Peduncle 1″ in fruit . . . 3. *unilocularis.*

1. C. retrospiralis, *Fisch.*

An interesting little plant with creeping rootstock, stout fleshy roots and radiating grass-like leaves 3–4″ by ·2–·25″ or up to 12″ by ·75″, acute or acuminate, often crisped or waved, costa distinct and 1–2 side-nerves not parallel. Spathe 3–4″ or more or less nearly equalling the leaves, sub-sessile, lower tube (including the inflor.) about ·3″ rather wider than the upper tube (above the spadix), which is slender and 2–4-times as long as the closely twisted blade. Ovaries 5–6, 3–more-ovuled, stigmas broadly elliptic or orbicular. Fruit shortly peduncled ovoid, not twice as long as broad.

Rivers and gravelly or sandy nalas in the forests or open, submerged or flowering when dry. The shorter spathes apparently occur when not submerged. Chota Nagpur, frequent! Probably in all districts. No specimens in *Cal. Herb.* from our area. Fl., Fr. c.s.

L. linear or linear-lanceolate, narrowed into a slender petiole or subsessile, sheathing. Spathe grey streaked and mottled with purple, the walls of the tube

* According to *Engler*. But very frequently the plants flower after the drying up of the water. The transverse partition is referred to as a septum in *F.B.I.* but it is perforated.

surrounding the male inflor. reticulate with transparent pits between the reticulations, the septum is recurved over tip but not entirely blocking the tube.

2. **C. spiralis,** *Fisch.* Syn. Ambrosinia spiralis, *Roxb.*

Similar in habit to *C. retrospiralis*, with vertical or horizontal rootstock and no stem. Leaves linear or more often rather linear-lanceolate and ·3–·4″ wide but occasionally up to ·6–·8″ wide, more distinctly petioled above the sheath. Lower tube of spathe (*i. e.* the part surrounding inflorescence) obconic about ·75″ long, tube above the spathe hardly any, blade up to ·3″ broad and open below, closed and twisted upwards and transversely rugose within, usually 2–3″ long only, but said to attain 4″ or more, dark purple especially inside, margin sometimes denticulate. Peduncle hardly any.

It is said to occur in all the provinces according to *Bengal Plants* but the material shows no specimens from our area, although the general distribution (from Bombay to Lower Bengal) makes it very probable that it occurs.

3. **C. unilocularis,** *Wight.* Syn. C. Roxburghii, *Schott*; Ambrosinia unilocularis, *Roxb.*

Habit of the last two, with linear lanceolate leaves, attaining 9–18″ by 1″. Peduncle distinct, clavate upwards. Spathe gibbous opposite the inflorescence, twisted immediately above, the septum at base of the twist, whole length said to attain the length of the leaves (*Roxb.*), purplish outside, inside deeper purple and beautifully dark spotted. Carpels 4–5.

Singbhum? (see below).

Although *Engler* says "*Herb. Kew*" in his monograph opposite the locality for this species there is no specimen at Kew and little is known of the species except from *Roxburgh's* drawing (of which *Wight's* is a copy). *Engler* describes the pistil as 4-gynous but *Roxburgh* figures it as with 5 stigmas and says ovary 1-celled.

A specimen of *Cryptocoryne* collected by me may possibly be this but it had only one flowering spathe, the rest in fruit and this belated flowering spathe was perhaps not fully developed: Rootstock stout about 4″ beneath the soil. L. with the sheaths about 4″ long then spreading flat on the ground for 5–7″ (in *Roxburgh's* drawing they are erect), breadth about ·25″, fleshy, entire or waved or with small teeth. Spathe twisted almost immediately above the inflor. and limb streaked with purple, 1·5″ long. Spadix ·3″. Ovaries 5–6 combined into an oblong 5-6-celled ovary about 2″ long in which the numerous ovules are almost axile, neck ending in 5–6 oblong processes (stigmas?), inside which are (and adhering partly to axis) 5–6 small stipitate papillose bodies (stigmas or rudimentary flowers?). Spathe limb smooth inside. Fruit ellipsoid-oblong ovoid-oblong ·6″ long, 5-celled with numerous seeds on a peduncle over 1″ long.

It is possibly *C. Roxburghii*, *Schott* with narrower leaves and shorter spathes than usual but the material is insufficient.

Singbhum in river beds! Fl. Jan.

15. PISTIA, *L.*

A floating stemless but stoloniferous gregarious tufted aquatic with sessile obovate-cuneate leaves in a rosette. Spathe very small, tubular below, open above, its short peduncle partly sheathed. Spadix adnate to back of the tube of the spathe, free above, bearing at the base a relatively large ovoid 1-celled ovary with conical style and discoid stigma. Male inflorescence of few sessile connate stamens beneath the apex of the spadix, with a ring of minute confluent

neuters below them. Anther-cells opening by vertical slits. Ovary with many subbasal and parietal or orthotropous ovules. Fruit membranous, few-seeded. Seeds albuminous, integuments strongly thickened towards the micropyle and forming a cap. Embryo ovate or cuneiform, minute, apical.

The seeds float and the first leaves of the seedling are roundish and lie flat on the water.

1. P. stratiotes, *L.*

Gregarious and resembling small floating cabbages with the obovate leaves 1–3″ long, rounded or retuse, nerves flabellate, raised beneath, pubescent. Spathe pale yellow or white, ·5″ long, obliquely campanulate, contracted near the middle.

In most districts ! Probably throughout the province but prefers the still backwaters of rivers especially in districts with a warm winter.
Fl. h.s. Fr. c.s.

FAM. 133. LEMNACEÆ.

Small or minute floating gregarious aquatics. Shoot (*frond*) not differentiated into stem and leaf, sometimes also rootless and subglobose, usually explanate and distinctly dorsi-ventral; sometimes also, from the direction and branching of the weak vascular system, a basal and apical portion is distinguishable. The branches grow from the upper (dorsal) side of the frond, but are at an early period enclosed in a pocket by the growth of the parent shoot and become lateral, they may be soon detached and become independent plants. Flowers most minute, monœcious, consisting of 1–2 naked stamens in the male and naked 1-celled ovary in the female, both male and female sometimes enclosed in a common minute membranous spathe. Stamens with 1–2-celled anthers. Ovary with short style and truncate or funnel-shaped stigma. Ovules 1–7. Fruit a bottle-shaped utricle. Seeds 1 or more with coriaceous testa, with or without albumen. Embryo axile cylindric.

Fronds flat with 1 or more rootlets. Fls. sunk in marginal clefts.
Anths. 2-celled . . . . . 1. *Lemna.*
Fronds very minute, subglobose, rootless. Fls. dorsal. Anths.
1-celled, sessile . . . . . 2. *Wolffia.*

1. LEMNA, *L.* Duck-weed.

Fronds explanate with one or more very fine roots. M. and Fem. fls. in marginal clefts enclosed together in a small transitory spathe. Male of 2 stamens (or a pair of 1-stamened flowers ?) maturing one after the other, with 2-celled (4-locellate when young) anthers and slender filament, anthers dehiscing by transverse slits, pollen muricate. Ovule orthotropous or half-anatropous.

Note.—Engler separates from *Lemna* the genus *Spirodela*, Schleid. This is distinguished by the daughter-shoot of the frond bearing at its base a small lobe which is considered to be a basal leaf. *Spirodela* has also several roots whereas *Lemna* develops only one to each frond (or frond branch). In *Spirodela* is included *L. polyrrhiza* and *L. oligorrhiza.*

1. Root 1:—
   a. Frond entire, branches obovoid, soon detached:—
      Frond asymmetric nearly flat both surfaces . . . 1. *paucicostata*.
      Frond orbicular or obovoid opaque, tumid beneath . . 2. *gibba*.
   b. Frond with serrate tip. Branches hastate persistent . 3. *trisulca*.
2. Roots more than one (*Spirodela*, *vide supra*):—
      Frond herbaceous, broadly obovate to orbicular 7-nerved 4. *polyrrhiza*
      Frond membranous shining ovate or oblong 3-5-nerved . 5. *oligorrhiza*.

Herbaria contain very few specimens of *Lemna* from our area, nor have I found time to collect them. In view of the wide-spread nature of these aquatics, however, it is probable that all the following, the descriptions of which I have to a great extent borrowed from *Sir J. D. Hooker*, will be found.

1. L. paucicostata, *Hegelm.*

Frond asymmetric, obovate or obovate-oblong, nearly flat on both surfaces, entire. Root 1, with acute root-cap. Ovule solitary.

Apparently throughout India, extending from Moradabad to Ceylon and Khasia. Santal Pargannahs, in stagnant waters, common, *Kurz*.! Probably in all districts.

2. L. gibba, *L.*

Frond symmetric, orbicular or obovoid, tumid beneath, entire, opaque, epidermis with flexuous walls, cells beneath very large. Root 1, root-sheath elongate, cylindric, root-cap acute. Stamens 2. Ovules 2–7. Utricle circumsciss. Seeds erect, anatropous.

Still waters throughout India, *J. D. H.*

3. L. trisulca, *L.* Ivy-leaved Duckweed.

A very distinct species from the lanceolate or oblanceolate daughter fronds being hastately attached and their remaining attached towards the middle or base of the parent shoot and in their turn often bearing 1–2 lateral younger fronds: the shoots or daughter-fronds ultimately develop a slender very tapering base, are often somewhat hastate and are more or less serrate at the tip; nerves 1 towards the base and three towards the apex. Root 1, with acute cap. Ovule solitary.

Bengal, *Roxb.* and *Kurz*! Not specifically recorded from our area but I think I have seen it and it is likely to occur.

4. L. polyrrhiza, *L.* Syn. Spirodela polyrrhiza, *Schleid.*

Fronds large orbicular or orbicular-obovate and up to ·3″ long, herbaceous flat or nearly so, 7-nerved towards apex and 1 towards base, usually purplish beneath. Roots several. Spathe 2-lipped. Stamens 2. Ovules 1–2.

A common species, probably throughout the province. Bengal, *Griffith*, *Kurz*, and others without definite locality!

5. L. oligorrhiza, *Kurz.* Syn. Spirodela oligorrhiza, *Heglm.*

Fronds elliptic-oblong, membranous, ·15–·2″ long, 3–5-nerved, purple beneath, collected in circinate groups. Roots 2–5 very long. Spathe 2-lipped, stamens 2. Style long. Ovule 1.

Bengal, frequent, *Kurz*!

2. WOLFFIA, *Horkel.*

The smallest known flowering plants consisting of minute oblong or subglobose rootless fronds flattened above, proliferous. Flowers without spathe, bursting through the upper surface. Male a sessile or subsessile 1-celled (2-locellate when young) anther, transversely dehiscent at top, pollen smooth. Female a globose ovary with short style and depressed stigma. Ovule 1 erect orthotropous. Utricle spherical indehiscent. Seed oblique, albumen fleshy scanty.

1. **W. arrhiza,** *Wimm.*

Frond subglobose or more cylindric.

Very common in Bengal, *Roxb.*, *Kurz*, and others. Probably throughout India.

FAM. 134. TYPHACEÆ.

(Excluding Sparganieæ.)

Aquatic or marsh herbs with creeping rhizome clothed with distichous scales and with erect distichous spongy linear leaves placed face to face (not equitant as in *Iris*). Flowers minute densely crowded in cylindric superposed spikes, the upper spike male the lower female. Fls. often intermixed with slender clavate bracteoles or simple or branched hairs. Perianth 0 (the slender hairs in the female are sometimes regarded as a perianth). Male fl. with 2–5, usually 2–3 or rarely only 1 stamen, filaments usually connate, tip of connective thickened. Fem. fl. seated on a slender elongate axis thickly covered with persistent hairs, in a few species in the axil of a membranous spathulate bract. Carpel 1 minute stipitate and narrowed into a capillary persistent style with a clavate or filiform stigma. Ovule 1, pendulous from the top of the carpel. Sterile female flowers occur on a yet longer axis or stipes with a clavate pistillode. Fruit becoming detached with the hairy stipes, very minute with a membranous pericarp, indehiscent or dehiscent by a lid on germination. Seed sometimes adnate to the wall, with very thin perisperm and fleshy endosperm. Embryo axile.

1. TYPHA, *L.* Reed-Mace; Cat's-tail.

Characters of the Family.

L. 3-gonous above the sheath, pollen 4-globate . . . . 1. *elephantina.*
L. semi-terete above the sheath. Pollen globose . . . . 2. *angustata.*

1. **T. elephantina,** *Roxb.* Hugla, *Vern.*; Greater Indian Reed-mace; Elephant-grass.

A gigantic gregarious marsh plant 6–12 ft. high with erect grass-like equitant leaves 4–6 ft. long, ·7–1·5″ broad, somewhat convex dorsally and concave ventrally, becoming narrower keeled and trigonous towards the sheath. Flowering stem embraced at the base by the leaf-sheaths, straight, glossy, spongy within the top forming the rhachis of the female and male spikes. Lower female spike 6–10″ long by ·3–1″ diam., finally brown, a deciduous foliaceous spathe embraces the whole inflorescence when young. Male spike 2–3″

above the female 8–12″ long, pale coloured with a basal spathe and 2–3 smaller upper ones, all deciduous, anthers 1–5, ·1″ long with 4-globate pollen. Bracts between the flowers very numerous, filiform 2–3-cleft. Fem. fl. with lanceolate stigma, mixed with clavate pistillodes and bracteoles with fasciated tips longer than the inner (perianth ?) hairs.

Marshes, jheels and river backwaters. Distributed from the United Provinces to Duars and Purneah! Probably in several other districts but not specifically noted. Fl. July-Aug.

It is used for stuffing elephant gaddis.

2. **T. angustata,** *Chaub.* Hugla, *Vern.*; Lesser Indian Reed-mace.

Similar in habit to the last and often up to 8 ft. high or somwhat more, usually 5–6 ft. Leaves up to 8 ft. long, ·3–·9″ wide, narrower above the sheath but lower parts of the leaves plano- or concavo-convex, plano-convex upwards, acute, often longer than the flowering stem. Female spike pale-brown ·3–·5″ wide in flower, up to ·7″ or ·9″ in fruit, sometimes 2 superposed with an interval but in that case there is no interval between the upper female and the male spike. Bracteoles of female subspathulate equalling the linear stigmas, both longer than the (perianth ?) hairs, mixed with clavate-tipped pistillodes. Pollen simple.

More frequent than the last and perhaps in most districts but not collected nor always discriminated. Shahabad, *Cal. Herb.*! Fl. May–June.

A yellow cake is made from the flowers (pollen ?) called "boor" and is much eaten according to *Stocks*.

FAM. 135. PANDANACEÆ

Trees or nearly stemless, stems when elongate with aerial or stilt-roots, simple or 2–3-chotomously branched, annulate, cylindric. Leaves long and narrow, tufted at the ends of the branches and spirally 3-farious, rigidly coriaceous, keeled with keel and margins spinulosely toothed, rarely unarmed. Flowers dicœcious, small, without intermixed bracts or bracteoles, crowded on simple or branched spikes (spadices) which are terminal and in the axils of the upper spathaceous leaves. Perianth 0. Male fl. with numerous stamens (but where sessile and without pistillode the limits of an individual flower are not discernible), filaments free or connate, anthers erect, basifixed. Fem. fl. with small or 0 staminodes; ovary of one to a variable number of carpels with corresponding number of cells; stigmas distinct, subsessile, papillose. Ovules solitary and suberect or many and parietal. Fruit of 1–several-celled woody or fleshy drupes angled by pressure with the neighbouring drupes, the whole forming a large globose ovoid or clavate syncarp. Seeds minute, testa striated, albumen hard fleshy. Embryo minute.

1. PANDANUS, *L. f.* Screw-pine.

Stems not climbing. Staminodes in fem. fl. 0. Carpels 1-ovulate. Seed large.

Arboreous or shrubby. Inflorescence sweet-smelling. Ovary several-celled . . . . . 1. *tectorius* (*fascicularis*).

Shrubby. Inflorescence fœtid. Ovary 1-celled . . . . 2. *fœtidus*.

1. **P. tectorius,** *Sol.* Syn. P. fascicularis, *Lamk.*; P. odoratissimus, *Roxb.*; Keora, *H.*; Kiya, *Or*; Kewa-kanta, *Beng.*

A bushy shrub or growing into a tree with stem 10–12 ft. high with many thick terete aerial and stilt roots. Leaves closely spirally 3-fariously imbricate, erect then drooping, 3–5 ft. long, abruptly caudate. Spathes white. Male inflorescence very sweet-scented, branched with a spathe at each branch, flowers pedicelled with the stamens spicately arranged on the floral axis (connate filaments ?). Female spikes stout unbranched subtended by 3-fariously arranged white spathes. Ovaries of 4–9 connate carpels, 6–20 on a spadix, in fruit trigonous obpyramidal woody 1·5–2″ long, with flat tubercled tops each tubercle crowned by a withered stigma; the whole syncarp ellipsoid drooping 4–10″ long and 4–8″ diam. deep orange-coloured on peduncles 5–6″ long.

Wild in the deltaic swamps of the Mahanadi, Balasore and Cuttack, where it forms a tree! Also common and semi-wild in other parts of the Orissa coast and will grow on sand. Sometimes cultivated in other parts (*e.g.* Ranchi, near the lake). Fl. r.s. Fr. May–June.

Roxburgh states that it is the white spathes of the inflorescence which yields the powerful fragrance so noticeable when this plant is in flower. The shrubby form is often used for hedges in Orissa as in the Casuarina plantation at Puri.

2. **P. fœtidus,** *Roxb.* Keor-kanta, kiya-kanta, *Vern.*

A much branched bush 5–6 ft. high. Leaves 2–4 ft. acuminate spinose toothed as in the last. Male inflorescence in the axils of white or pale yellow spathes as in *P. odoratissimus* but the smell fœtid and very disagreeable. Fls. without an elongate torus, covering the rhachis of the spike so that it is impossible to define the boundaries of each, anthers long linear with very short filaments conical at the base. Female spike with very numerous flowers each of a single carpel. Drupes crowded angular obpyramidal, 1-celled, each with a smaller pyramidal crown and an apical prickle (the modified stigma), the whole syncarp very compact and red when ripe, 3–4″ long.

In village shrubberies and hedges, occasional in Purneah, Santal Parganahs and Chota Nagpur! Fl. c.s. Fr. May–June.

FAM. 136. CYCLANTHACEÆ.

Perennial herbs or small unarmed palm-like shrubs with distichous or spiral petioled flabellate leaves, usually deeply 2–4-fid or -partite, plicate. Flowers monœcious, both sexes densely whorled or spirally arranged on a simple cylindrical or oblong spadix, which is enveloped when young by 2–6 spathes inserted on the top of the peduncle. Male perianth 0 or with a many-toothed mouth and obliquely stipitate, stamens 6 to many, filaments connate at the base and confluent with the fleshy perianth, anthers adnate, pollen ellipsoid, smooth, pistillode 0. Fem. perianth 0 or of 4 short distinct or connate tepals, sometimes not distinguishable from the neighbouring flowers, frequently accrescent and hardened in fruit, staminodes often 4. Ovary free or immersed in the tissue of the spadix, depressed-quadrate,

truncate or 4-lobed at the apex, 1-locular. Style 0 or pyramidal, stigma solitary or 4. Ovules many anatropous, on parietal placentæ or pendulous from the apex of the cells. Fruits forming a fleshy syncarp with berries distinct or confluent containing many small albuminous seeds on fleshy swollen placentæ. Embryo minute axile straight or curved, sub-basal.

1. CARLUDOVICA, *Ruiz & Pav.*

1. **C. palmata**, *R. & P.*

A small palm-like plant with very short stem but the leaves on long erect petioles attaining 4–6 ft. in height, blade mostly 4-partite with each segment cut into linear acute lobes. Spadix 1–2 ft. in height crowded with flowers, 4 males stipitate round each female which is immersed in the spathe. Male perianth many-toothed. Female with filamentous staminodes which give a curious fibrillose appearance to the spadix, stigmas 4-sessile radiating, finally swollen. Ovules very many on 4 placentæ.

Often cultivated in grass green-houses and usually mistaken for a palm. Native of South and Central America.

FAM. 137. PALMACEÆ.

Trees or shrubs, usually with a terminal unbranched crown of large leaves, sometimes widely scandent, without aerial roots. Leaves alternate sometimes distichous, plaited, first ones simple, mature palmate or pinnately divided, rarely simple; petiole sheathing. Flowers mostly small in simple or copiously branched inflorescences (spadices) sheathed at the base and often at the base of the branches by spathes, sessile or sunk in the surface of the rhachis, monœcious or diœcious, the males and females nearly always differing in form. Inflorescence rarely terminal and ending the life of the tree (monocarpic). Perianth usually dry or coriaceous, in 2–3-merous whorls, usually free, imbricate or valvate. Stamens 3 or 6 rarely more, anthers versatile, rarely basifixed. Ovary superior, apocarpous, of 3 1-celled carpels, or syncarpous and 1–3-celled, stigmas usually sessile. Ovules 1–2 in each carpel, large, sessile, or with short thick funicle or adnate to the cell wall, anatropous. Fruit various, apocarpic or syncarpic, indehiscent. Seeds erect or laterally attached, raphe usually branching all over the testa; albumen horny or bony, sometimes ruminate. Embryo small, in a small cavity near the surface of the albumen.

I. Leaves in a terminal crown, stem never climbing. Fruit not scaly (1–9):—
  A. Leaves pinnately divided:—
    1. L. 2-pinnate. Stamens many. Ovary 3-celled . . 1. *Caryota.*
    2. L. 1-pinnate or -pinnatisect. St. 3–9:—
      a. Ovary syncarpous, stigmas 3. Spadices androgynous:—
        Spadices infrafoliar. Ovary 1-celled . . . . 2. *Areca.*
        Spadices interfoliar. Ovary 3-celled . . . . 3. *Cocos.*
      b. Ovary of 3 free carpels:—
        Flowers diœcious. Lowest leaflets often thorns. Fruit of drupes. Terrestrial . . . . . 4. *Phœnix.*
        Spadices androgynous. Fem. in a terminal head. Fruits in a large syncarp. Æstuarial, stemless . 5. *Nipa.*

B. Leaves flabelliform or palmately divided:—
1. Flowers 2-sexual:—
a. Ovary 3-lobed. Very large palms . . . . 6. *Corypha*.
b. Ovary of 3 free carpels sometimes cohering in the styles:—
Carpels 3-gonous. Style filiform . . . . 7. *Licuala*.
Carpels globose. Styles 3. . . . . 8. *Livistona*.
2. Flowers diœcious. Fem. very large:—
M. fl. sunk in cavities of the large cylindric branches of the spadix . . . . . 9. *Borassus*.
II. Leaves scattered. Stem often scandent. Fruit covered with closely imbricating scales:—
Spathes tubular at least below. Fem. fl. sessile on the spike . 10. *Calamus*.
Spathes at first enclosing the inner ones, then open, outermost deciduous. Fem. fl. with a bracteate stipes . . . . 11. *Dæmonorops*.

Many palms occasionally cultivated in gardens are omitted.

1. CARYOTA, *L.*

Erect, sometimes tall, palms with very large 2-pinnate or 2-pinnatisect leaves and obliquely dimidiately flabelliform, or cuneiform leaflets, petiolules or bases swollen at their insertion. "Flowering from the upper leaf-sheaths and successively downwards," alternately male and female or androgynous. Spathes 3–5, incompletely tubular. Spadices interfoliar, shortly peduncled, much fastigiately branched; branches slender, pendulous. Fls. monœcious solitary and male, or 3-nate with the intermediate female. Sepals 3 rounded, imbricate. Male petals 3 linear-oblong, valvate, stamens numerous, filaments short, anthers long. Fem. fl. subglobose, petals 3 rounded, valvate, ovary 3-celled, stigma 3-lobed. Ovules erect. Fruit globose, 1–2-seeded, stigma terminal. Seeds erect, albumen ruminate. Embryo dorsal.

Trunk solitary, tall. Spadix 8–10 ft. St. 40–50 . . . . 1. *urens*.
Trunks several (soboliferous), low. Spadix 4–5 ft. Stamens about 15–25 . . . . . 2. *mitis*.

1. C. urens, *L.* Mari, *H.*; Salapo, *Or.*; Indian Sago Palm.

A rather stout but very beautiful palm 30–50 ft. high with trunk slightly ringed. Easily recognised by its immense 2-pinnate leaves 15–20 ft. long with leaflets shaped somewhat like those of the Maidenhair fern but 4–8″ long and præmorsely jagged, oblique with the upper margin produced and caudate.

Deep ravines in the Saitba forest, now unfortunately nearly extinct (once frequent near Tuia)! Fairly common in some parts of the Mals of Orissa (*e. g.* the Tamna forest)! Sometimes planted. Fl. April–Aug.

L. 10–12 ft. broad, petiole very stout and old sheaths reticulate. Spathes 1·5 ft. Spadix 8–10 ft. long, the branches all reaching nearly the same level (corymbose but drooping). Flowers a female between two males. Males ·5″ long or more, cylindric in bud and about three times as long as broad, stamens about 40–45. Fruit globose ·75″ diam., acrid.

The fibre of the leaf-sheaths is used. The pith yields a good sago which fact has largely caused the destruction of the tree. The inflorescence is tapped for toddy.

2. C. mitis, *Lour.*

Only found in gardens in our area with soboliferous stems 12–25 ft. high. L. and inflorescence smaller. M. fl. ·25″ long, st. 15–25. Fruit ·5″ diam.

2. ARECA, *L.*

Slender, often tall palms with annulate stems and a crown of pinnate leaves. Spadices infrafoliar (from axils of fallen leaves), branched. Male fl. 1–2-nate, many towards the ends of the branches, minute, sepals small, petals obliquely lanceolate, valvate. Stamens 3 or 6, anthers basifixed, erect. Fem. fl. much larger, few at the base of the branches of the spadix, sepals and petals orbicular, imbricate, accrescent, ovary 1-celled, stigmas 3 sessile. Ovule basal erect. Fruit a coriaceous drupe with a single seed with truncate base and ruminate albumen. Embryo basilar.

1. **A. catechu,** *L.* Gua, *S.*, *Beng.*; Supari, *H.*; The Areca or Betel-nut Palm.

A very graceful palm with a slender trunk 40–70 ft. high but only 6″ more or less in diam., very straight and uniform. Leaves 4–6 ft. with numerous leaflets 1–2 ft. long, upper imperfectly separated. Spathe glabrous, compressed. Spadix much branched, rhachis stout compressed, branches with filiform tips bearing more or less distichous minute male flowers with 6 stamens. Fem. solitary at the base and axils of the branches, sepals ·3″ ovate, obtuse; petals subsimilar, staminodes 6, connate. Fruit ovoid 1·5–2″, smooth, orange or scarlet.

Everywhere cultivated in the open village lands, succeeding best in the moister districts.

Yields the Betel nut.

3. COCOS, *L.*

Unarmed palms with (in our species) tall trunk and pinnate or pinnatisect leaves with narrow leaflets. Flowers monœcious on simply panicled erect, at length drooping interfoliar spadices, the branches bearing scattered fem. flowers, often between two males towards their bases and males above. Spathes 2 or more, lower short, upper fusiform or clavate. M. fl. unsymmetric, sepals small, valvate, petals oblong acute, valvate, stamens 6, anthers linear, erect, pistillode minute or 0. Fem. fl. usually much larger, ovoid, perianth greatly accrescent; sepals imbricate, petals convolute with imbricate tips. Ovary 3-celled, cells with short style and recurved stigmas. Ovule 1 in each cell, sub-basilar. Fruit large, ovoid, terete or trigonous, 1-seeded, with thick fibrous pericarp and bony or stony endocarp with 3 basal pores (the remains of the 3 cells). Seed adhering to the endocarp, albumen solid or hollow. Embryo opposite one pore.

A genus of some 30 species, several of which are now introduced into gardens but only the following is at present important in our area.

1. **C. nucifera,** *L.* Nariyal, narikel (the tree or ripe fruit), dab (the immature fruit), *Vern.* The Coco- or cocoa-nut (also in commerce, cokernut).

A beautiful palm 60–90 ft. high with straight or sinuous stems and a crown of feathery leaves 8–20 ft. long with numerous close equidistant linear or linear-lanceolate leaflets 2–3 ft. long. Spadix

divided into numerous drooping spikes bearing fem. with a few herm. fl. near the base, the upper portion being densely covered with male flowers. Fruit obtusely 3-quetrous, 10–15″ long. The endocarp and contained seed is the well-known cocoanut.

In villages, esp. near the houses in most districts but only occasional in the dryer ones, increasing in numbers in the damper districts and becoming abundant near the sea in Orissa. Fl. h.s. and beginning of r.s. and ripening nearly a year afterwards.

Coir is obtained from the fibrous pericarp and every part is used. A "dab" after slicing off the apex yields a most refreshing cool drink in the hot season.

4. PHŒNIX, *L.*

Tall or very short palms with the stems clothed for a considerable time with the bases of the fallen leaves. Leaves pinnate with linear, lanceolate or ensiform leaflets which usually lie in different planes and are frequently fascicled, lowest often spinescent. Flowers dioecious, yellowish, coriaceous, in branched erect or ultimately drooping branched interfoliar spadices. Calyx cupular 3-toothed. Male petals 3, obliquely ovate, valvate, stamens usually 6 (3–9) with subulate filaments and erect dorsifixed anthers, pistillode minute or 0. Fem. fl. globose, calyx accrescent, petals rounded, imbricate, staminodes 6 or a 6-toothed cup, carpels 3 free, stigmas sessile, uncinate. Ovule erect. Fruit an oblong drupe with fleshy pericarp. Seed with very hard or cartilaginous grooved testa and equable or subruminate albumen. Embryo dorsal or sub-basilar.

A. Leaflets more or less fascicled and in different planes :—
  1. Trees attaining 40 ft. :—
    Lflts. 6–18″ by ·75–1″. Fr. 1–1·3″ . . . . . 1. *sylvestris.*
  2. Shrubs, or trunk under 20 ft. :—
    Stem 6–12 ft. covered with the spiral leaf-bases. Lflts. not very rigid, base not thickened nor decurrent . . . 2. *humilis.*
    Stem 15–20 ft. and much stouter than type with relatively small tessellated leaf-bases . . . . . var. *robusta.*
    Stem very stout, bulbous and tessellated, under 2 ft. Lflts. very rigid with swollen and decurrent bases . . . 3. *acaulis.*
B. Leaflets not fascicled, 2-farious :—
  Stem stout soboliferous 6–20 ft. Æstuarial . . . . 4. *paludosa.*
  Stem short slender, not soboliferous. Rupicolar . . . 5. *rupicola.*

The descriptions are mainly after *Brandis.*

Phœnix dactylifera, L., the true Arabian and Persian Date, is a tree allied to *P. sylvestris.* It is cultivated in Sind and the Punjab but only specimens are occasionally grown in our area, where it does not thrive.

1. P. sylvestris, *Roxb.* Khajuri, *H.*; Indian Date Palm.

A tall palm, often 40 ft. high, with the trunk densely covered with the bases of the fallen petioles. Leaves greyish-green, 7–12 ft. long, leaflets 6–18″ by ·75–1″, the lowest converted into long spines 4″ long, much fascicled with the fascicles up to 3″ apart and lying in different planes. Spathe thick, almost woody. Male inflorescence white, scented, compact, on a short peduncle Fruiting peduncle finally drooping 2–2·5 ft. long, terminating in large bunches of spikes bearing orange to reddish-brown drupes 1–1·2″ long. Flesh sweet but very scanty. Stone ·7–·75″ long, nearly half as broad as long.

Frequent in open lands in Tirhut, Gaya, the northern and eastern parts of Hazaribagh and towards the Orissa coast, occasional in other parts of the province! Fl. h.s. Fr. May-June, also seen in fruit Sept.-Oct.

The leaves are used for mats and baskets. It is frequently tapped for the preparation of *toddy*, the cuts are successively made in the lower but growing part of the crown and greatly disfigure the tree.

2. **P. humilis,** *Royle.* Khajur, *H.*; Kita, *K.*; Polot, *Th.*

Stem very rarely 12 ft usually 4–6 ft. at time of flowering, attains 9″ diam., densely covered with the stumps of the fallen petioles, often developing root-suckers when the primary stem has been burnt or injured. Leaves 4–8 ft. Leaflets pliable, 10–20″ long, ·3–·5″ wide, fascicled, not lying in one plane, base not thickened nor decurrent on the rhachis which is 1″ broad at the base, spines up to 3″ long. Fruiting peduncle 2–4 ft., compressed, ·5″ broad. Fruit ·5″ long, orange to black.

Common on the dryer ground and ridges in the "bhabar" and hills of N. Champaran! Chiefly on ridges of white clay schist in Singbhum! Fl. March-April. Fr. May-June.

The spadix frequently exceeds the leaves in fruit.

The uses are the same as of *P. acaulis* and I am not quite sure that the distinguishing characters between the two species always hold good.

Var. **robusta,** *Beccari.* Syn. P. robusta, *Hook. f.*

Hooker describes this as follows:—Trunk 15–20 ft. as thick as a man's body closely clothed and appearing tessellated from the sheaths of the fallen leaves. L. about 3 ft. long, lflts. fascicled 4-farious, strict, strongly conduplicate, fruiting peduncle 2 ft. Trunk with the appearance of a *Cycas*.

Parasnath, 4000 ft., *J.D.H., etc.*

3. **P. acaulis,** *Buch. Ham.* *Vern.* names as for *P. humilis*, also Pind Khajur, *H.*

Stem thick and ovoid, not more than a foot high and as broad as high, covered with the persistent leaf bases. Leaves 2–6 ft. long with stiff fascicled leaflets 10–20″ long, ·3–·7″ wide, not in one plane, lowest reduced to strong spines 2–6″ long, base of lflts. thickened and decurrent on the rhachis. Spadix 6–10″ long in flower, elongating to 1–3 ft. in fruit, suberect. Drupe ·5–·6″ long, red finally black.

A common plant in Chota Nagpur, especially on poor clay soils in open grassy forest! Fl. April. Fr. May-June.

The fruits are much eaten by pea-fowl. The leaves are used for thatching, mats, etc. A sago is prepared from the interior of the stem.

4. **P. paludosa,** *Roxb.* Hital, *Or.*

Soboliferous with stems 6–20 ft. high and 3–8″ diam. covered to a great extent by the dark fibrous network of the sheaths and long pointed petiole-bases but lower parts bare, annulate. Leaves 3–10 ft. long, lflts. 2-farious in one plane, not fascicled, flaccid except the lowest spinescent ones, longer 12–18″, tips filiform. Spathe much as in *P. sylvestris*, scurfy outside. Spadix with numerous spreading branches, up to 3 ft. long. Stamens 6, short. Female with 6 scale-like staminodes. Drupe ·5″ long, shining black when ripe, pulp a dirty looking soft greenish-black of an intolerable taste (*Roxb.*). Seed cartilaginous, embryo at the base.

Sub-gregarious in the mud of the Mahanadi delta. Balasore! Cuttack! Very common and often forming thickets. Fl. March–April. (? It was in young fruit in May.)

5. **P. rupicola,** *T. And.*, is a handsome small palm with dark green leaves up to 10 ft. long with a marked spiral twist and curved rhachis and the leaflets about 18″ in a more or less vertical plane. Fruit shining yellow. It grows on rocks near the rivers of the Sikkim and Bhotan Hills and Duars and is sometimes cultivated for ornament.

5. NIPA, *Wurmb.*

A gregarious palm with branched rootstock but no aerial stem. Leaves pinnatisect with lanceolate plicate leaflets. Spathes many. Spadix terminal, branched erect in flower, drooping in fruit. Fls. monœcious, males in catkin-like lateral branches of the spadix, female in a globose terminal head, perianth glumaceous. M. fl. minute mixed with setaceous bracteoles; sepals linear, with broad truncate inflexed tips, imbricate. Stamens 3, filaments cuneate, anthers linear basifixed. Fem. fl. larger with 6 rudimentary displaced sepals, staminodes 0. Carpels 3, tips free each with an oblique stigmatic line. Ovules 3, erect. Fruits forming a large globose syncarp of many obovoid angular 1-celled, 1-seeded carpels with pyramidal tips and sometimes infra-apical stigmas, pericarp fleshy and fibrous, endocarp spongy and floury. Seed erect, grooved on one side, testa coriaceous viscid within and adherent to the endocarp, albumen equable. Embryo basilar, obconic.

1. **N. fruticans,** *Wurmb.*

Stem underground sometimes thick. Crown of leaves dense. Leaves 12–18 ft. long, evenly pinnatisect, leaflets linear or linear-lanceolate with very characteristic bifurcate soft spines or scales scattered along the midrib beneath with their common base adnate to it and each fork subulate ·2–·3″ or more long. Fruits roughly, often unequally, 3–4-sided and compressed and with a variable number of subsidiary flutings and rounded ridges, 3–4″ long by 2·5–3·5″ wide.

This common Sunderbans palm has not been reported from our area, but I mention it here as I have picked up its fruits on the Orissa coast and it may possibly occur in the Mahanadi delta.

6. CORYPHA, *L.*

Tall stout monocarpic palms with very large flabellately multifid leaves with spinous petiole and very large terminal paniculate spadix with many tubular spathes. Flowers small, 2-sexual. Calyx cupular 3-fid. Petals 3, connate below in a stipes, ovate, acute, imbricate or subvalvate. Stamens 6, filaments subulate, anthers dorsifixed. Ovary 3-lobed, 3-celled; style short, subulate. Fruit of 1–3 globose fleshy drupes with basilar styles. Seed erect, globose or oblong with equable albumen. Embryo spiral.

1. **C. umbraculifera,** *L.* Tali, *Beng.* The Talipat palm.

A magnificent palm attaining 80 ft. high and 2·5 ft. diam., the young trunk covered with the large sheaths and petiole bases, subsequently annulate. L. 8–16 ft. diam. cleft nearly to the middle into linear segments and with a petiole 5–10 ft.

long. At flowering time the top of the tree is a huge pyramidal yellow panicle 10-20 ft. in height. After fruiting it dies.

Only occasionally cultivated; chiefly in Orissa.

2. **C. elata,** *Roxb.* Bajur, *Beng.* is nearly as tall with spirally ridged trunk and more slender petiole 6-12 ft. long. Panicle much smaller ovoid. Occasionally planted.

7. LICUALA, *Thunb.*

Short- rarely tall-stemmed palms with more or less orbicular or flabellate plicate deeply partite or palmately divided leaves and usually spinose petioles. Spadices interfoliar, sheathed by tubular coriaceous persistent spathes. Flowers usually small, scattered, 2-sexual. Bracts and bracteoles obscure or 0. Calyx cupular or tubular, lobed. Corolla tubular at base, lobes coriaceous, valvate. Stamens 6 with cordate anthers, filaments compressed subulate, united into a tube at base, sometimes adnate to corolla-tube. Ovary of 3 free or nearly free truncate 1-ovuled 3-gonous carpels, styles filiform. Ovules erect. Drupes small with style terminal. Seed erect, globose, free, often hollowed on ventral face, albumen equable. Embryo dorsal.

1. **L. peltata,** *Roxb.* Thai, *Kol*; Kurud, *Beng.*

Stems erect 2–5 ft., rarely 10 ft., with very large erect palmately compound orbicular leaves 3–5 ft. diam., segments narrowly obcuneate, about 20, 4–10″ wide at the top, 3–5-lobed with the lobes again 2-lobed, retuse, or emarginate. Spadix erect 4–8 ft. long with simple drooping racemes 8–18″ long of subsessile white and green flowers, turning brown with age. Fruit ellipsoid, orange-coloured, ·5″ long.

In muddy streams or swamps with moving water in the forests of Saranda, Chota Nagpur! Similar localities in the Mals of Orissa (Sulia reserve, Aran forest, etc.)! Fls. Dec.–April. Fr. March–May.

Young leaves with a deciduous rufous tomentum, lobes of median leaflets blunt, of lateral acuminate, strongly plicate. Petiole flat above keeled below, with 2 rows of short recurved black prickles. Racemes (or spikes) woolly or tomentose, about 5–8 only, spathes 12″ with 3-4 sharp teeth. Calyx obconic ·3–·5″ long, toothed or shallowly lobed. Cor.-tube scarcely longer with spreading or reflexed acutely triangular downy lobes ·25–·3″ long. Carpels 3-gonous appressed united above in the style.

Leaves used for mats, etc. Elephants feed on the lower parts of the stems.

8. LIVISTONA, *Br.*

Tall palms with annulate trunk and large orbicular, flabellately plicate leaves split to the middle into 2-fid narrow lobes, petiole long with spinose margins. Spadices interfoliar, long-peduncled, erect, fruiting pendulous, loosely panicled. Spathes many, tubular, sheathing. Flowers minute 2-sexual, sepals 3 rounded, imbricate. Corolla valvately 3-lobed, coriaceous. Stamens 6, filaments subulate, united in a ring, anthers cordate. Ovary of 3 nearly free globose carpels, styles short free or coherent, stigmas minute. Ovules basilar, erect. Drupes 1–3, globose oblong or ellipsoid with subterminal style. Seed erect, ventral face hollowed, albumen equable. Embryo dorsal.

1. **L. chinensis,** *Br.* is often cultivated in gardens and attains 25 ft. but in its young state often grown in tubs. Leaves reniform with the segments deeply 2-fid, long acuminate and pendulous. Drupe olive-coloured.

Other species of *Livistona* are also occasionally cultivated.

9. BORASSUS, *L.*

Trunk stout. Leaves fan-shaped. Flowers diœcious. Spadices very large, simply branched, spathes open. Male fls. small, mixed with scaly bracteoles, secund in two series in small cymules or capitate spikelets and protruding one by one from the cavities between the large broad closely imbricating bracts of the stout cylindric branches of the spadix. Sepals 3, narrowly cuneate, tip inflexed, truncate, imbricate, petals shorter, obovate spathulate, imbricate, dry ; stamens 6, anthers subsessile large oblong, pistillode of 3 bristles. Female fl. larger, globose, scattered singly on the branches of a sparingly branched spadix. Perianth fleshy, much accrescent, sepals reniform, petals smaller, convolute, staminodes 6–9, ovary globose, sub-trigonous entire, or 3–4-partite, 3–4-celled, stigmas 3, sessile recurved. Ovules basilar, erect. Fruit a large subglobose drupe with 1–3 fibrous pyrenes ; pericarp thinly fleshy, stigmas terminal. Seeds oblong, top 3-lobed ; testa adherent to the pyrene, albumen equable, hollow. Embryo subapical.

1. **B. flabellifer,** *L.* Tal, tar, tali, tala, tadi, *Vern.* ; The Palmyra or Toddy (*tadi*) palm.

A very large palm 70–100 ft. in height and 2 ft. diam. near the ground, often swollen near the middle, when young covered with the dry leaves and bases of the petioles, old naked and marked with the sheath scars. Leaves 3–5 ft. diam. with 60–80 linear-lanceolate (not drooping) segments, folded along the midrib. Petiole 2–4 ft. long semiterete, edges spinosely serrate. Branches of male spadix clustered, about 12″ long and 1″ diam. including the closely imbricate broad truncate bracts, the flowers seated on the inner upper side of the cavities, petals spreading ·1″ long. Fem. fl. 1″ diam. Fruit 6″ diam.

In nearly all districts, cultivated. In Chota Nagpur it chiefly occupies a zone or belt skirting the Gangetic plain from the Sone to the Ganges at Sahebganj. It is, however, common on the Palamau and Hazaribagh plateau within this zone esp. on gneissic rocks and occurring naturalised in the scrub jungles. In Gaya it is very common. Fl. March–May. Fr. August or the following March–May. Native of Africa.

It is largely tapped for "toddy," the sugary juice from which it is prepared exuding from the cut spadices and which is often used in place of yeast for making bread in camp. The leaves are used for fans. Portions of the fruit and seeds are eaten and there are very numerous other uses for parts of the tree.

10. CALAMUS, *L.* Cane.

Usually slender palms, rarely erect, armed with long spines or recurved prickles and usually scandent, very frequently climbing by the aid of long flagella copiously supplied with recurved prickles, which may be a continuation of the leaf-rhachis or an appendage to the leaf-sheath or a continuation of the spadix or its spathes. Leaves not confined to a terminal crown, pinnate or pinnatisect, midribs often armed. Spadices interfoliar, compound, elongate, with tubular or open persistent spathes passing into bracts and bracteoles (spathels and spathellules). Flowers small polygamo-diœcious, in usually distichous often scorpioid spikelets, solitary or 2-nate in the spathel-

lules. Male calyx cupular 3-toothed, petals 3 acute, coriaceous, valvate, stamens 6, filaments short, anthers dorsifixed. Fem. calyx as in the male, slightly accrescent, corolla tubular below, 3-fid, valvate; staminodes forming a cup. Ovary incompletely 3-celled, clothed with retrorse scales, style with 3 stigmas. Ovules basilar, erect. Fruit with thin pericarp clothed with retrorse closely imbricating polished scales, style terminal. Seed smooth or pitted, albumen equable or ruminate. Embryo ventral or basal.

A. Rhachis flagelliferous, leaf-sheaths not flagelliferous:—
Lflts. inequidistant, broad. Fruiting per. pedicelliform . 1 *latifolius.*
B. Rhachis not flagelliferous, leaf-sheaths some flagelliferous:—
1. Spathe elongate persistently tubular:—
Lflts. fascicled. Fruiting per. not pedicelliform . . 2. *viminalis.*
Lflts. equidistant, slender. Fruiting per. pedicelliform . 3. *tenuis.*
2. Primary spathes at first tubular, soon split open:—
Leaflets narrow equidistant. Frt. per- not pedicelliform . 4. *guruba.*

1. **C. latifolius,** *Roxb.* Var. marmoratus, *Beccari*; Gauri-bet, *Or.*

A stout widely scandent cane armed with numerous often subverticillate close reflexed, or young patent, horizontally flattened, lanceolate prickles over 1″ long and numerous very short triangular ones. Leaves very long with the rhachis produced into a long flagellum armed with recurved prickles, leaflets very inequidistant, mostly geminate with both members of the pair on the same side of the rhachis, oblong-lanceolate about 10″ by 1·5″, or sometimes 20″ by 4″, ending in a bristly acumen and margins with distant setiform erect prickles. Sheath with a marbled appearance. Inflorescence with spreading distichous somewhat zigzag branches with the internodes sheathed with tubular-obconic spathes with oblique cuspidate densely ciliate mouth, joints of male with recurved or nearly straight spikes 1·5–·7″ long with closely imbricate orbicular distichous bracts bearing a flower and distinctly 2-lobed cupular bracteole in their axils. Principal spathes shaped like those on the branches, sometimes split at apex, armed with broad short and rather longer spines. Fruiting calyx pedicelliform. Fruit subglobose, nearly 1″, pale.

Along streams in the mountains of the mals of Orissa! Fl. Dec.-Jan.

Young parts rusty tomentose. Leaflets not setose on the nerves, sometimes flabellately clustered, petiole pulvinate below on the sheath with sharp narrow spines. M. fl. ·2″ long, calyx ·1″ long.

The cane is said not to be as good as the *Kanta-bet* but superior to the *Pani-bet*.

2. **C. viminalis,** *Willd.* Var. fasciculatus, *Becc.*; Pani-bet, *Or.*; Beñt, *K.*, *S.*

Often sub-erect and tufted, ultimately climbing in favourable situations, rather stout, armed with slender straight, not flattened, very sharp reflexed spines, ·5–1·5″ long on the rhachis and petiole and also flat ones on the stem (leaf-sheaths). Leaf-rhachis not produced into a flagellum but a flagellum arises laterally on the leaf-sheaths. Leaflets many inequidistant, often 2–4 close one above the other, then a wide interval, linear-lanceolate, 6–12″ by ·5–1″ ending in a bristle, margins and costæ beneath with setiform prickles. Inflorescence very long with the main rhachis ending in a flagellum, inter-

nodes long each covered by a long tubular spathe with oblique acuminate mouth, surface with scattered reflexed small prickles. Main branches of spadix 7–15″ bearing in male many slightly decurved sec. branches 3–6″ long with short scorpioid distichous spikes, lower ·3″ long with very small ovate acute bracts each with a cupular bracteole and flower. Sepals free ovate ·06″ long, petals oblong acute ·1″ long, many-nerved. Spathes on the branches tubular with an acuminate tip, mouth glabrous or slightly minutely ciliolate. Fruiting calyx explanate. Fruit subglobose, ·3″ (–·5″, *F.B.I.*), pale.

Purneah! Damp ravines in Singbhum, occasional! Puri, very common! Fl. Sept.–Oct. Fr. April–May.

Young parts with a white powdery tomentum. Setæ on the leaflets erecto-patent. Spines on the flagellæ scattered hooked. Female spikes 2–3″ long with oblique truncate close bracts ·08″ long. Bracteole of M. with short obtuse lateral lobes, of female larger more acute. Albumen equable.

The cane is used for baskets, etc., but is considered inferior.

3. C. tenuis, *Roxb.*

A very slender cane with feathery pari-pinnatisect leaves and numerous close equidistant linear-ensiform 3-costate leaflets, the 3 costæ with slender sparse bristles above, mid-rib only sparingly spinulose beneath. Leaf-sheaths with very slender flagellæ, compressed and unarmed or nearly unarmed in their basal portion, terete and armed upwards with scattered solitary or somewhat confluent claws. Rhachis of inflorescence very long and flagelliferous, bearing partial decompound inflorescences at intervals, spathes elongate tubular, lower with a short limb and scattered recurved spines, partial spathes unarmed and scurfy when young, spathels densely crowded cymbiform. Male fls. quite exserted from the involucres and corolla with an unusually long tube. Fem. fl. exsert accompanied by a well-developed neuter.

Along our northern boundary. Bettiah, *Hieronymus*! Purneah! Fl. r.s.

The canes are ·4–·75″ diam. when sheathed, only about the size of a quill when stripped. Leaves very like those of *guruba*, with 20–30 lflts. each side, 8–12″ long by ·3–·5″, the setæ on the costæ however far more slender, often ·25″ long, only their base thickened. Fls. distinctly 3-4-seriate. Fruit ·5″ diam., mucronate, seated on the pedicelliform perianth, scales pale with a shallow median channel.

4. C. guruba, *Ham.* Kanta-bet, *Or.*

A large climber with stems (covered with the leaf sheaths) often glaucous, densely armed with flattened spines of various lengths, longer ones ·7″, shortest conical. Leaves 3–5 ft. long, shorter with 30–40 close equidistant dark-green linear leaflets each side 6–12″ by ·5–·7″, smaller upwards, setose on the 3 or 2 lateral costæ beneath, on the central one only above, margins setose, petiole and rhachis armed with long recurved and short conical spines beneath and on the margins, not flagelliferous, but many of the leaf-sheaths flagelliferous, spines sometimes geminate (not 3–5-clawed as in the somewhat similar-looking *Dæmonorops*). Inflorescence with numerous distant spathes and much panicled branches on a very slender rhachis ending in a long flagellum. Spathes at first tubular throughout and enclosing the panicles, splitting open above and ·7″ broad contracted to the tubular base and persistent, brown and shining. Partial panicles

(from the axil of each spathe) pyramidal or thyrsiform, 6–9″ long. Lower branches 2–3″ or longer and again branched, very slender with closely appressed tubular spathes with truncate mouth shortly acuminate on one side, ultimate m. spikes (spikelets) very numerous, erect, ·5–·3″, with adnate minutely cuspidate spathels and very shallow or flat minutely 2- (laterally) lobed spathellules. Calyx tubular ·05″ long with short ovate teeth, corolla ·1″, petals connate one-third up, acute, filaments adnate below. Bracts on the female spikes with more prominent cusps. Spathellules flat. Fruit globose ·3″, scales yellowish-green with brown and scarious margins.

Purneah! Along streams in the hills, Mals of Orissa! Fl. March–April. Fr. Dec.

Leaves very like those of *tenuis* (*q.v.*). Lflts. about 35 each side, margins usually smooth or very slightly bristly-spinulose. The flagellum is prickly armed throughout (cp. *tenuis*).

Canes used for ropes, etc.

11. DÆMONOROPS, *Blume.*

Closely allied to *Calamus* (and included as a section of that genus in *Genera Plantarum and Nat. Pflanz. Fam.*), but spathes not tubular, large, at first closed and outer completely enclosing the inner and panicle, deciduous. Inflorescence more compact and the rhachis never elongate or produced into a flagellum. Fem. flower with a bracteolate pedicel. Leaf rhachis produced into a long flagellum.

1. **D. Jenkinsianus,** *Mart.* Bet, beñt, *Vern.*; Cheka-bet (in the Duars).

A large climbing cane with large pinnate leaves about 6 ft. long. ending in a long armed flagellum with 3–5-fid claws. Leaflets 2 ft. by ·6–·75″ equidistant linear, finely acuminate, 3 costæ sparsely setose above with very long bristles, central only beneath, margins setulose, petiole and rhachis at first furfuraceous with many hooked spines or claws beneath and on margin. Outer spathe densely armed on the back with acicular and flat often compound spines, over 1″ broad, 2-keeled with inflexed margins and a long spinescent beak, inner unarmed. Spadices subaxillary with short stout prickly peduncle. Male spadix thyrsiform, dense, flowers deeply grooved. Fruit ·7″ (*F.B.I.*, only ·4″ in my specimen, perhaps not mature), marked with characteristic longitudinal grooves passing through the centre of the scales which have scarious margins and broad scarious tips.

One of the commonest canes in the evergreen swamps of the Duars and Tarai! and probably extending into Purneah. Fl. h.s. Fr. Dec.–Jan.

FAM. 138. CYPERACEÆ.

Mostly perennial, grass-like herbs with sympodial rootstock, rarely annual. Stems rarely with knots at the nodes,* usually 3-quetrous and with the uppermost internode below the inflorescence usually very long. Leaves 0 or elongate and grass-like, often 3-farious,* with closed, very rarely open sheaths and ligule* insignificant or 0. Flowers 1–2-sexual, much reduced, solitary in the axils of close imbricating

* Compare *Gramineæ*.

bracts (*glumes*) forming "spikelets," spikelets often forming an inflorescence of a higher order. Bracteoles 0. Perianth of 6 scales or bristles or of an indefinite number of hairs or 0 (in *Cariceæ* female flower with a *utricle* † enclosing the ovary). Stamens 3 (apparently the outer whorl of a typical Monocotyledonous flower), anthers linear, basifixed and apex entire.* Ovary superior, syncarpous, 2–3-carpellary, 1-celled, style short or slender with 2–3 stigmatic branches.‡ Stigmas not feathery. Ovule 1 basal erect anatropous. Fruit dry 1-seeded (nut), seed usually free from pericarp. Embryo small basal median enclosed by the floury albumen.

Mostly plants of damp places or marshes.

I. Two-sexual flower-bearing glumes in a spikelet always at least one usually many above the 2-3 lowest empty glumes. Nut neither bony nor enclosed in a utricle:—
  A. Fl. glumes all distichous (apparently few lowest in *Courtoisia* sometimes spiral). Bristles always 0:—
    1. Glumes many. Rhachilla of spikelet persistent:—
      a. Stigmas 3, nut more or less 3-gonous . . . 1. *Cyperus.*
      b. Stigmas 2, nut not at all 3-gonous:—
        Nut laterally compressed . . . . . 2. *Pycreus.*
        Nut dorsally compressed . . . . . 3. *Juncellus.*
    2. Glumes often few. Rhachilla of spikelet deciduous leaving a disc above the empty glumes:—
      a. Stigmas 2. Spikelets always in capitate spikes. Gl. 4–5 only. Nut compressed . . . . 4. *Kyllinga.*
      b. Stigmas 3. Spikelets capitate or spicate:—
        Bisexual glumes 1–12, not winged . . . . 5. *Mariscus.*
        Bisexual glumes 1–3 only, prominently winged . 6. *Courtoisia.*
  B. Flowering glumes many spirally arranged or sometimes lower only sub-distichous. Bristles often present:—
    1. Style base swollen over a button-like apiculus of the nut, a constriction between the apiculus and nut:—
      a. Leaves 0. Bristles nearly always present . . 7. *Eleocharis.*
      b. Leaves usually present at base of stem. Bristles 0:—
        Style persistent flat and hairy, or if deciduous not leaving a prominent button on the nut. L. glabrous . . . . . 8. *Fimbristylis.*
        Style linear glabrous, deciduous and leaving a button on the nut. L. or their sheaths with fine hairs . . . . . 9. *Bulbostylis.*
    2. Style-base passing gradually into the nut (sometimes deciduous a little above the base leaving a small apiculus). Bristles or scales often present:—
      Bristles, linear or filiform or 0 . . . . . 10. *Scirpus.*
      Bristles cut into numerous capillary segments . 11. *Eriophorum.*
      Bristles 6, inner 3 with expanded sub-petaloid tips . 12. *Fuirena.*
      Bristles 2, scale-like elliptic and enclosing the nut . 13. *Liphocarpha.*
  C. Fl. glumes few, only the next above the 3 or 4 empty 2-sexual, rarely also a second 2-sexual. Lower glumes distichous, uppermost spiral:—
    Nut beaked by the persistent dilated style base . . 14. *Rhynchospora.*
II. Two-sexual flowers 0. Spikes or spikelets 1–2-sexual:—
  Spkts. with 1 fem. fl. and 1 or more male or entirely 1-sexual. Nut bony usually polished, not enclosed in a utricle . . . . . 15. *Scleria.*

† For the morphology of the "utricle" see *Carex*.
* Compare *Gramineæ*.
‡ Referred to shortly as stigmas, the shaft or haft only being called the style.

Spkts. all reduced to 1 flower, in the axils of spicate glume-like bracts, upper bracts in a spike with male flowers and the lower female or lower spikes entirely female, uppermost entirely male. Nut enclosed in a utricle . 16. *Carex*.

1. CYPERUS, *L.*

Annual or with perennial rhizomes. Leaves mostly towards the base of the erect stems, rarely reduced to sheaths, bracts under the inflorescence usually resemble ordinary foliage leaves. Spikelets more or less laterally compressed, with many glumes, in heads or spikes which are arranged in simple or compound umbels or sometimes reduced to a single head or spike. Rhachilla persistent (exc. in *aristatus*), sometimes winged (see note below). Glumes distichous, at least the lower deciduous in fruit, 2 lowest empty, next above several or many 2-sexual (very rarely reduced to 1 or 2 flowering and then the lower glume not enclosing the upper), all subequal, uppermost 1–3 male or empty. Hypogynous bristles 0. Stamens 3–1, with linear or oblong often apiculate anthers. Style branches ("stigmas") 3, base not tumid nor articulate on the nut which is usually equally 3-gonous and 3-sided (a few species have unsymmetrical or slightly compressed or quite globose nuts).

Cyperus as defined above excludes *Pycreus*, *Juncellus* and *Mariscus* as in the *Flora of British India* and as I understand is being done in the *Flora of the Upper Gangetic Plain*.

Much use has been made in the *F.B.I.* of the wings of the rhachilla, and it seems to me that the distinction of narrow and broad wings (in itself a purely relative distinction difficult to work without a suite of specimens) widely separates some closely allied species. The rhachilla may be winged in various ways, either the wings are the very thin continuous margins of the compressed rhachilla and lie in the same plane as that of the rhachilla, or the wings are at right angles to this plane and discontinuous, but form no part of the glumes or, thirdly, the wings appear to be the detached bases of the glumes themselves and can therefore only be seen after these fall. *Cooke* (wrongly as I think) states as a universal rule that the wings form part of the glumes.

Of other characters I am a bit doubtful of the value of the length of the bracts but that of the glumes appears to be a very good character and to vary within singularly narrow limits.

α. Stigmas 3, minute or tapering, nut unsymmetrical and angles corky. Tank floaters:—
Style long with minute stigmas. Infl. capitate . . . 1. *cephalotes*.
Style short slightly compressed and widening upwards, stigmas as long, somewhat tapering. Infl. sub-capitate 2. *platystylis*.

β. Stigmas 3 filiform. Nut symmetrically 3-sided (exc. sometimes in *flavidus* and *difformis* and exceptionally in others):—

I. Slender or cæspitose annuals (sometimes perennial in *haspan*). Glumes small in all (under ·07″ except No. 11). Spp. 1–11:—

A. Spikelets clustered (*i. e.* not spicate). Spp. 1–8:—

1. Glumes very short, as broad as long. Spkts. in dense globose heads, hds. umbelled. Nut subequally 3-gonous:—
Gl. ·025″ long, obovate, truncate. Nut ·02″ . . 3. *difformis*.

2. Glumes slightly longer than broad, ·02–·04″ long. Spikelets numerous digitate. Nuts subglobose:—
Rhizome 0. Nut globose or sub-compressed, obscurely 3-sided. St. 1 . . . . . 4. *flavidus*.
Rhizome slender. Nut globosely-obovoid, 3-sided. St. 2–3 . . . . . 5. *haspan*.

3. Glumes somewhat longer than broad, ·02–·05″. Nuts symmetrically 3-gonous :—
H. 2–8″. Gl. ·04–·05″ mucronulate. Nut obpyramidal ·02″ . . . . . 6. *amabilis*.
H. 2–6″. Spkts. chestnut-cold. Gl. ·04–·05″ with awnlet about ¼th blade. Nut linear-oblong ·03″ . . . . . 7. *castaneus*.
H. 1–3″. Spkts. ferruginous. Gl. ·03–·04″ with awnlet recurved, ½ to as long as blade. Nut narrowly obovoid ·02″ . . . . . 8. *cuspidatus*.
B. Spikelets spicate rather than clustered but rhachis short (long in *iria*). Spp. 9–11 :—
1. Spikelets very short (·2–·4″ long only) in contracted spikes resembling heads, rhachis on fall of spkts. marked with spiral disciform scars :—
Gl. ·05–·06″ long with recurved awnlets as long as blade . . . . . 9. *aristatus*.
2. Spikelets elongate, not deciduous nor leaving closely scarred rhachis :—
Gl. very short and broad, ·04–·05″ truncate. Spikes long . . . . . 10. *iria*.
Gl. ·13–·15″ acute or mucronate. Spikes short . 11. *compressus*.
II. Perennials with thick rootstocks or thick or slender rhizomes. Glumes mostly over ·07″ (exc. in some Nos. 24–28). Spp. 12-end :—
A. Spikelets clustered, not spicate. Spp. 12–15 :—
1. Spikelets in simple heads or reduced to a single spkt. :—
a. Spkts. much compressed, white or cinnamomeous :—
Spkts. ·4–1″ long. Median gl. ·15–·17″. Nut ·06–·08″ . . . . . 12. *niveus*.
Spkts. ·2″ long, rarely ·3–·5″ in a dense head like a *Kyllinga*. Gl. ·05–·08″. Nut ·03″ . . 13. *leucocephalus*.
b. Spkts. not much compressed. Gl. ·18″. Sand plants . . . . . 14. *arenarius*.
2. Spkts. 3–9 in a cluster, clusters in compound umbels :—
Gl. ·06–·07″ long. Style very short. Nut broadly ell. . . . . 15. *diffusus*.
B. Spikelets distinctly spicate. Spikes in simple or compound umbels. Spp. 16-end :—
1. Rhachilla with usually 2 wings at each internode parallel to median plane of flower, free from glume or 0. Robust herbs. Spp. 16–28 :—
a. Nut oblong or narrowly ellipsoid. Inflorescence usually more or less feathery with spikelets of unequal length and slender rhachilla, not conspicuously shorter than the glabrous spikes (open to exceptions but *cp*. next section). Spp. 16–23 :—
i. L. long (often as long as stem). Bracts long. Wings of rhachilla narrow and hyaline (usually). Gl. often loosely imbricate :—
† Gl. ·07–·1″ :—
Spkts. ·7–1″ long, nodding or spreading on the lax spike. Gl. distant, truncate, reddish . . . . . 16. *distans*.
Spkts. erect, at least in fruit. Gl. mucronulate . . . . . 17. *nutans*.
Spikes more densely fascicled, usually grey . . . . . var. *eleusinoides*.
†† Gl. ·18″ long, loosely imbricate as in *distans* 18. *Thomsoni*.
ii. L. few or short (up to 6″) or 0. Bracts short. Wings of rhachilla variable in breadth. Gl. closely imbricate :—

Stem almost 3-winged at top. Spkts. terete. Gl. ·08″ with incurved margins all round when dry. Wings very narrow . . . 19. *malaccensis.*
Stem 3-gonous. Gl. ·1″. Wings broader. Bracts rarely half the length of the umbel 20. *tegetiformis.*
Stem obscurely 3-gonous at top, sometimes obscurely septate when dry. Wings as in 20. Bracts ½ to as long as umbel. Spkts. reddish . . . . . 21. *corymbosus.*
Stems terete, septate or articulate when dry. Bracts very short, almost scale-like . . 22. *articulatus.*

iii. L. usually short (4–8″) or 0 rarely 16″. Bracts very long and overtopping the decompound umbel. Wings of rhachilla very strong embracing the ovary and nut:—
Gl. ·12″ rounded at back. Nut half as long, oblong, style shorter than nut . . . 23. *tegetum.*

b. Nut broadly ellipsoid or obovoid. Spikelets of nearly equal length usually stiffly spreading in fruit, in almost cylindric spikes with spreading branches at their base. Rhachilla compressed:—

i. Rhachis of spike or glumes more or less scabrous or pubescent:—
Gl. ·05–·07″, glabrous. Spkts. ·15–·3″ . . 24. *pilosus.*
Gl. ·06–09″ hispid on top of keel. Spkts. ·7″ 25. *babakensis.*
Gl. ·1″ glabrous. Spkts. ·6–1·2″ . . . 26. *procerus*, var. *lasiorrhachis.*

ii. Rhachis of spikes and glumes glabrous:—
Gl. ·09–·1″. Rhachilla wings narrow or 0 . 26. *procerus.*
Gl. ·05–·06″. Rhachilla wings broad. Spkts. spreading . . . . . 27. *exaltatus.*
As in 27 but spkts. denser, erecto-patent, dull-coloured . . . . . 28. *radiatus.*

2. Rhachilla with wings only apparent after fall of the glumes which have broad margins decurrent on the rhachilla (either adnate to the wings or wings being bases of the glumes):—
Base of stem slender. Infl. lax . . . . 29. *rotundus.*
Base of stem woody. Rays of umbel very slender 30. *tuberosus.*
Base of stems slender. Inflorescence subcapitate 31. *polystachyus.*

1. C. cephalotes, *Vahl.*

Stems and roots slender. Leaves 2–5, about two-thirds as long as the stem. Spikelets many in a single dense compound head ·4–·75″ diam. often with broad bracts above the 3 (–5) foliaceous ones. Spikelets ·25–·5″ long by ·12″ broad, rigid, often bent, with stout persistent angular, hardly winged rhachilla. Glumes closely imbricate, cymbiform, green with red or brown, ·1″ long. Nerves exc. midrib obscure. Style with minute stigmas. Nut ovoid, unequally trigonous (*i. e.* somewhat plano-convex), passing gradually into the linear style, stipitate below, corky.

Floating in tanks with slender stolons (*Clarke*). No specimens from within our area but it extends from Bogra in Bengal to Madras and therefore almost certainly occurs in Orissa. Fl. May.

Stems 4–16″. L. about ·17″ broad. Bracts up to 4–8″ long. St. 3–2, filaments broad, anthers large, linear-oblong. Nut ·08″ long (or half glume, *Clarke*).

Clarke remarks that in those Cyperaceæ which float in tanks which do not dry up a corky thickening of the cells, especially towards the lower angles of the nut, enables them to float and vegetate among the rotting surface vegetation of the tank.

2. **C. platystylis,** *Br.*

Usually robust with stems and leaves up to 2 ft. long, stoloniferous. Inflorescence compound, but heads often very short-peduncled, so that they often appear as one, 1–10″ diam. Spikelets bright brown, umbellately or digitately clustered, ·2–·5″ long. Glumes (lower) ·1″ long, broadly ovate or ovate-oblong concave, scarcely cymbiform (cymbiform, *Clarke*), the back with three green rather distant nerves, sides thinner nerveless but streaked with red, apex minutely mucronate. Nut dorsally compressed and subplano-convex but keeled and with lateral ridges so that it is 3-gonous, the ridges yellow and corky.

A tank-floater (*Clarke*). On banks of the Ganges (not apparently floating), *Kurz*. Bhagalpur (Nathpur), *Ham.*! Santal Parganahs, *Kurz*! Also Rajshaye and Lower Gangetic Plain so probably over the whole of the North-Eastern districts. Fl., Fr. May–Feb.

Stolons covered with ovate striate brown scales. Stems flattened below, 3-gonous upwards, ·5–·7″ thick at base, up to 42″ long and subsolitary (*Clarke*) or clustered (*Kurz's* specimen). L. up to ·3–·5″ wide with scabrous cutting edges. Bracts 2–18″, leaf-like. Rhachilla with strong transverse ledges but not deeply excavate after fall of glumes. Fil. ligulate; anths. linear-oblong with a small red mucro. Style about half nut, flattened; stigmas nearly as long as style.

3. **C. difformis,** *L.*

Tufted, annual, 6–20″ high, well marked by its acutely triquetrous weak stems and congested globose grey heads of linear-oblong spikelets ·17–·3″ long with very numerous minute glumes only ·025″ long, broader than long (when unfolded), obovate and truncate. The heads are ·3–·5″ diam. usually several to many in irregular umbels with bracts 2–10″ (usually 2–6″) long, sharply keeled. Nut broadly ellipsoid, subequally trigonous, very pale brown or straw-coloured, nearly as long as the glume.

In wet ground, sand of river-beds, etc., frequent. Sikkim Tarai, *King*! Bhagalpur, *Ham.*! Monghyr, *Ham.*! Singbhum, common! Hazaribagh, *C.B.C.*! Chota Nagpur, *Wood*! Throughout India, *C.B.C.*, and almost certainly throughout our area. Fl., Fr. Aug.–Jan.

L. usually somewhat shorter than the stem, ·1–·2″ broad, several-nerved, flaccid. Umbel often appearing lateral from the longest bract being erect. Rhachilla with pale centre and grey wings between the ledges. Glumes with green centre and red or brown sides, when dry with almost white centre tips and margins. Nut ·02″, surface neither striate nor punctate (even under high magn.).

4. **C. flavidus,** *Retz.*

An annual cæspitose sedge or stems subsolitary, 2–12″ high with the yellow or brown inflorescence usually occupying over half its height and very compound, 2–9″ diam. Spikelets very numerous ·2–·3″ rarely elongating to ·5″ long (after fall of lower glumes), linear. Glumes minute ·02–·04″ long, ovate-oblong (when unfolded), with rounded not keeled back triangular in shape and more opaque than the more hyaline sides, apex rounded, midrib and nerves very obscure and no mucro. Stamens 1, more rarely 2. Nut practically globose or very obscurely 3-sided, white and minutely verrucose (under high mag.) when quite ripe ·01–·015″ long, with a minute stipes.

Very common in rice-fields. Monghyr, *Ham.*! Western Bengal, "common everywhere in rice-fields, wet places etc.," *Kurz*! Ranchi, *Clarke*! Hazaribagh.

Clarke! Manbhum, *Clarke*! Puri, *Walsh*! No doubt in all districts. Fl., Fr. April–Dec. Apparently always annual. "Lives about 3 months," *Clarke*.

Very closely allied to *haspan* and sometimes mixed with it. L. 0 or flaccid and overtopping the stem, ·1″ broad. Bracts similar. In fruit the white nuts are visible between the opened glumes. They are plano-convex according to *Clarke* "with plane face to rhachilla," 3-gonous according to *Cooke*, but in the many specimens I have observed they are as described above and the plant comes very near to some *Juncellus* and *Pycreus*. Rhachilla slender blotched with red.

5. C. haspan, *L.*

A tufted herb with many equal stems 3–15″ high or stems scattered on the horizontal rather slender creeping rhizome. Inflorescence simple or a compound umbel with numerous unequal rays up to 2·5″ long and bearing 3–8 stellately spreading rather slender linear-lanceolate grey or reddish spikelets ·2–·4″ long by ·04–·05″ broad. Glumes ·04–·06″ long, ovate-oblong (unfolded), not or slightly keeled and obscurely nerved, obtuse or sometimes minutely mucronate. Stamens 2–3. Nut ·015–·02″ long, globosely obovoid, trigonous, smooth or minutely verrucose (under high magn.). Style slightly longer than nut.

Kissenganj (Purneah)! Behar, *J.D.H.*! Monghyr, *Ham.*! Jamalpur, *Cal. Herb.*! These are the only specimens seen from our area, but *Clarke* states that it is abundant throughout India in rice-fields. Fl., Fr. May–Sept. Perennial but often flowering on fibrous roots the first year.

Stems variable, sometimes stout, 3-gonous or sub-3-alate above. L. sometimes 0, ·12–·17″ wide with inflated sheaths. *Clarke* says that the umbel may be thin and straggling (as in our specimens) or dense with innumerable spikes, bracts short or long. Anthers linear-oblong, often with bristly tip.

6. C. amabilis, *Vahl.*

An elegant small sedge with cæspitose stems 2–8″ high terminating in a compound (rarely simple in very small specimens) usually decompound umbel of many clusters of yellow and brown linear spikelets ·2–·5″ long or sometimes (after fall of some of the glumes) up to ·7″ or 1″ long, ·04–·06″ wide. Glumes close numerous, laxer and more spreading in fruit, ·04″ long only, lower rarely ·05″, narrowly cymbiform, minutely mucronate. Nut very small, 3-quetrous, obpyramidal, pale yellow (ripe ?) when fresh, brown when dry, scarcely ·02″ long.

Very common in rice-fields, etc. Behar, *Kurz*! Chota Nagpur, all districts, plains and plateaux! Fl., Fr. April–Dec.

Leaves one-third to half as long as stems, finely acuminate, ·06″ broad, quite glabrous. Rays of umbel 1–4″ long. Spikelets usually brown down the centre and golden on the edges. Rhachilla with brown midrib and thin scarcely winged margins, concave but not excavate between the ridges. Glumes 3–5-nerved on the back, mucro variable (according to *Clarke*, always very small, straight, and usually pointed in specimens seen by me). Anther small oblong. Style somewhat shorter than the ripe nut, stigmas nearly as long as style, very slender. Nut (under high magn.) has lines of minute raised dots.

7. C. castaneus, *Willd.*

A pretty little cæspitose sedge 2–6″ high with chestnut-coloured linear spikelets ·2–·35″ long (or after fall of lower glumes up to ·7″ long) in mostly simple (a few compound in larger specimens) umbellate heads. Glumes 15–30 (15–70, *Clarke*) minute, linear-oblong (when folded), scarcely cymbiform, obtuse, brown, with the green

keel excurrent as an erecto-patent or recurved awnlet about one-fourth as long as the glume. Nut ·03″ linear-oblong, with parallel sides, 3-quetrous, dark red. Style much shorter than the nut.

Singhbum, in moist fields! Hazaribagh (Giridih and Parasnath), *Clarke*! Fl., Fr. Sept–Dec.

Roots of very delicate fibres. Leaves filiform, several in the cluster, mostly shorter than the stems. Bracts with a broad base gradually filiform upwards, mostly twice the diameter of the head or in compound umbels sometimes exceeding the few rays, which may attain nearly 2″ in length. Stamen usually 1 (sometimes 2) with small oblong anthers. Style-branches short. Glume ·04–·05″ long without the awnlet, slightly 2-lobed, the sides ending in rounded shoulders broader than the 3-nerved keel. Nut very closely minutely punctate (under high magn.), three-fourths as long as glume.

8. C. cuspidatus, *H. B. and K.*

A very small sedge often only 1″ high, rarely 4″, much resembling the last but usually a ferruginous-brown rather than chestnut coloured (though *Clarke* says that the colour in both is somewhat variable), best distinguished by the somewhat longer awnlet and especially by the nut being obovoid ·02″ long only. The close simple (very rarely compound) heads of spikelets often form a continuous sub-globose mass over-topped by the few filiform bracts. Glume (with the excurrent awn) ·05″, awn recurved about half to three-fourths as long as the retuse conduplicate blade which is only nerved in the keel. Nut oblong-obovoid.

In drying up rice fields and sometimes associated with the last. Purneah, *Kurz*! Monghyr, *Ham.*! Singhbum! Hazaribagh. *Clarke*! Manbhum (Barakhar). *Cal. Herb.*! Barkuda (Chilka Lake), *N. & C.* Fl., Fr., Sept.–Nov. Annual. *Clarke* says that it is distributed throughout India.

L. shorter than the stems, very slender. Bracts sometimes ·3″ long. Glume same shape as in *castanous*, blade only ·03–·04″, awn sometimes (*e.g.* in the Monghyr specimen) as long as the 2-lobed blade. Nut ·02″ long, under high magn. minutely punctulate in close longitudinal lines, chestnut-coloured.

9. C. aristatus, *Rottb.*

A small sedge with the habit of a *Kyllinga*, very well marked by reason of the small dense heads of spikelets ·2–·4″ long with the brown glumes furnished with recurved awnlets as long as the blade, length of glume together with the awn ·05–·06″.* Nut oblong or narrowly oblong-obovoid 3-quetrous, brown, ·02–·027″ long, minutely mucronate with the style-base.

Ranchi, *Clarke*! Hazaribagh, *Clarke*! Fl., Fr. Oct.–Nov.

Stems tufted, 3-quetrous or sub-3-alate. L. usually shorter, ·05–·08″ broad. Rays of umbel, if present, few, ·2–·7″ long or heads all clustered and sessile, globose or oblong, ·25–·4″ long, the rhachis on fall of the closely packed spikelets marked with prominent spiral disciform scars. Bracts 2–5 slender, tapering, up to 2″ long. Glumes with the blade sometimes shorter than the awn, keeled, ovate-oblong, nerved to the margin. Stamen 1. Style slender, a little shorter than the nut and capillary stigmas a little shorter than the style.

10. C. iria, *L.*

Rhizome 0. Stems tufted clustered 4″–2 ft. high, 3-quetrous. Spikelets in simple or compound spikes or sub-racemose on the branches of a decompound inflorescence, main branches of inflores-

* *Cooke* says that the glume is $\frac{1}{8}$″ long. Possibly a mistake for $\frac{1}{12}$″ or else the east and west plants are different forms.

cence umbellate with compressed peduncles 0–5″ long much swollen at their base. Glumes very broad and truncate, flowering 5–20, ·04–·05″ long conduplicate keeled but when opened out rather broader than long with broad scarious nerveless sides, scarcely imbricate in fruit and nut sometimes slightly exceeding the glume, black, 3-quetrous, microscopically punctulate, style much shorter than nut.

Common in rice-fields. Bhagalpur, *Ham.*! Patna, *Wall.* (No. 3360)! Monghyr, *Ham.*! Singbhum! Manbhum, *Camp.*! Khurda, *Walsh*! No doubt in every district. Fl., Fr. Aug.-Jan.

Luxuriant plants attain 3 ft. in height. Very distinct in the short broad glumes not longer than the black nuts and scarely imbricate in fruit but very variable (like most of the genus which grow in more or less drying-up swamps) in size. Leaves shorter or as long as stems. Bracts under inflorescence attain in large plants 12″ by 2″, 2 or 3 always exceeding the inflorescence. Inflor. varies from 2″ to 20″ in diam., with a cluster of sessile spikes and several long branches again carrying umbels of spikes or compound racemes, subtended as are the partial spikes by filiform bracts, and setaceous bracts or glumes are frequent at the base of the spkts. Spkts. variable in length, the spikes sometimes ending in an elongated spikelet. Glumes 7–9-nerved on and close to keel (3–5-nerved on back, *C.B.C.*), keel sometimes scabrid. Rhachilla broad flattened but not winged. Nut oblong-obovoid.

11. C. compressus, *L.*

Rhizome 0. Stems clustered erect and diffuse 6–15″ long (up to 30″, *Clarke*) and whole plant a somewhat grey- or silvery-green. Spikelets large, much compressed, ·4–·6″ long elongating to 1·2″ after fall of lower glumes, ·08–·15″ broad, 3–many in a simple terminal head or short spike, or heads also umbelled on rays 1–3″ long. Glumes cymbiform, ·13–·15″ long, ovate when unfolded, with keel produced into a short cusp or mucro or in some glumes scarcely excurrent, but tips very acute, lateral nerves 3–5, broad margins white scarious. Nut obovoid ellipsoid 3-quetrous ·05″ long with rather concave faces, shining brown or black.

Sandy bank of Ganges, *Kurz*! Throughout Chota Nagpur, common! Puri, *Walsh*! Chilka Lake, *Hooper*! Fl., Fr. July–Dec. Annual.

Leaves usually numerous and rather shorter than the inflorescence, bracts overtopping the inflor. by 1–3″, ·1–·12″ broad. Spikelets in *forma pectiniformis* (*Kurz*, Western Bengal and Bihar) 1″ long and with very excurrent keel, always linear when mature. Rhachilla said not to be winged (*Clarke*), but it has sometimes a distinct dotted wing or margin, which does not extend beyond the prominent ledges; internodes of rhachilla long.

12. C. niveus, *Retz.*

A small pretty sedge, tufted from the stems arising very close together on the sympodial horizontal rhizome, about 4″ high when first coming into flower, often 15″ in grass. Leaves rather numerous narrow with filiform tips, shorter than the stems. Spikelets white or pale, 4–9 together in a terminal head supported by linear or filiform bracts ·7–2″ long, much compressed, ovate-lanceolate to oblong ·4–1″ long by ·15″ wide with many (20–40) boat-shaped obtuse glumes, the midrib scarcely produced into a mucro, other nerves strong about 6 each side. Nut prominently 3-quetrous somewhat obovoid, ·06–·08″ long with short base of style at top, style about as long as glume.

Most conspicuous after jungle-fires in savannahs. Purneah! Singbhum! Ranchi! Hazaribagh (Parasnath, from base to top in grassy places), *Kurz*! Fl. Feb.-June.

Stems thickened at the base, 1-seriate, with strongly nerved sheaths below. Median glumes ·15–·17″, upper and lower somewhat shorter. Stamens 3.

13. C. leucocephalus, *Retz.*

A small sedge with the habit of the last but very much resembling a *Kyllinga* with one dense globose white head of spikelets ·2″ long or less (in large forms up to ·5″ by ·2″, *Clarke*). Glumes rather more variable in size then usual ·05–·08″ long, oblong-lanceolate, whitish or cinnamomeous with hyaline margins, subobtuse. Stamen 1. Nut ·03″ long, oblong-ellipsoid 3-gonous, apiculate (as in last), black with pale reticulations.

Monghyr, *Wall.* (Cat. 3445C)! Manbhum, *Campbell*! In sandy places under shrubs, Manbhum (Barakar), *Kurz*! Fl., Fr. May.

Wallich's specimen is only 3″ high. Rhizome very short woody with close stems thickened at the base. L shorter than the stem, filiform, ·05–·06″ wide. Heads with 8–50 compressed spikelets each with 12–20 glumes or sometimes only 8–10. Glumes keeled, obscurely 3-nerved. Stigmas 3 about as long as style.

On one sheet *C. leucocephalus* is mixed with *Kyllinga brevifolia* and the similarity is remarkable.

14. C. arenarius, *Retz.*

An interesting little sedge with a wiry creeping rootstock often deep down in the sand, with vertical branches. Leaves wiry or terete and fleshy, often recurved, 4–10″ with rather inflated strongly striate sheaths at base. Stems 4–12″ with an erect bract looking like a continuation of it except for the sheath at its dilated base. Spikelets pale, finally brown, in single terminal globose heads ·5–·7″ diam., each spkt. ovoid or elliptic-oblong ·27–·3″ long. 9–16-fld. Glumes not much compressed, elliptic-concave scarcely keeled, rounded at tip but midrib sometimes ending in a mucro. Anthers 3, tip red but not crested. Ovary oblong, style short, stigmas 3 longer than style. Nut (*fide F.B.I.*) unequally trigonous concavo-convex, dusky black one-third length of glume.

On sand-dunes on the coast from Chandpur! to Puri! Fl. Feb.–May–June.

Branches with their sheaths obconic above narrowing to the rhizome. *Clarke* describes the glumes as boat-shaped and strongly 3-nerved* and rounded. In my specimens the lowest empty glumes are about 7-nerved and muticous, the fl. glumes 11-nerved and often mucronate, ·18″ long. Style ·07″. Filaments very long, flattened.

The plant acts as a sand-binder.

15. C. diffusus, *Vahl.*

Rather robust with short rhizome and with broad leaves and bracts ·3–·6″ wide, flat and green-nerved. Umbel usually decompound 4–12″ diam. Spikelets 3–9 together digitate, ·3–·5″ long and ·06–·08″ wide. Glumes cymbiform, broadly ovate (when unfolded) cuspidate, ·05″ long or with the cusp ·06–·07″ long, rather distant in fruit. Nut broadly ellipsoid and 3-quetrous, about two-thirds as long as glume.

Clarke says throughout India except the dry west. The specimens are chiefly confined to the very moist belt from the Sikkim Tarai to S. India and eastwards. It may occur in Purneah and on our eastern fringe.

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* I have since examined *Clarke's* specimen (also collected at Puri). The glumes are rather opaque but are many-nerved. I fail to see 3 especially strong ones.

16. **C. distans,** *L. f.*

A robust (depauperated specimens may be very small) rather leafy sedge 1–3 ft. high with relatively very large decompound umbellate panicles often 1 ft. across of loosely spicate linear spikelets ·5–·7″, decreasing to the top of spike with very slender wavy rhachilla, semi-patent and distinct in flower, patent in fruit. Glumes very narrow erect, appressed to rhachilla and only slightly or not overlapping one another, ·07–·08″ long, truncate or very obtuse, white-margined above. Rhachilla after fall of some of the glumes up to ·75″ long, with narrow alternating hyaline ultimately caducous wings. Nut grey to dusky black oblong or narrowly ellipsoid ·05–·07″ long.

Monghyr, *Ham.* (*Wall.*, No. 3366 E) ! Singbhum ! Fl., Fr. r.s.

Stems often ·5″ diam. at base, stoloniferous (*fide Clarke*) with stolons up to 2′ long by ·06″ wide, clothed with dark-brown elliptic acute scales. L. often as long as stem, ·25–·35″ broad. Umbels sometimes reduced to a single head 2·5″ diam., rays in robust plants sometimes 2 ft. long. Bracts like the leaves, up to 8, exceeding the head, with broad base. Spkts. red, with filiform bracts often at their base. Fl.-glumes slightly obovate when unfolded, sometimes retuse, red-striate or midrib 3-nerved green. St. 3. Ovary linear, stigmas 3 about as long as style which is shorter than nut.

17. **C. nutans,** *Vahl.*

A robust rather leafy sedge 2–4 ft. high from a stout woody root-stock. Leaves 20–30″ long by about ·3–·45″ wide, narrowed both ends. Spikelets grey-brown in a large decompound umbel on the ultimate branches of which they are spirally spiked, ·2–·35″ long, suberect, not distinct but forming more or less of a thyrse, usually subtended by a bract or glume with a long awn. Glumes 6–12 (in my specimens. *Clarke* records many more, up to 20, and then of course the length of spkt. would be greater), linear or oblong ·08–·1″ long obtuse but midrib produced into a short aristula, nerves 2–3 each side of midrib, sides scarious. Rhachilla not very distinctly winged. Nut oblong or oblong-oblanceolar, 3-quetrous, ·06″ long, very pale (perhaps not ripe) or brown or dusky black (*Clarke*), with a small apiculus or mucro after fall of the style which is only ½–¾ length of nut with 3 very slender stigmas about as long as nut.

Often near streams in the jungles. Monghyr, *Cal. Herb.*! Rajmahal Hills, *Kurz*! Ranchi, elev. 3000 ft. ! Singbhum, elev. 2000 ft. ! Manbhum, *Wood* ! Fl., Fr. Aug.-Oct.

Stems often ·6″ diam. at base, not stoloniferous (?), often several stems together. L. often as long as stem up to ·45″ broad, many-nerved. Rays of umbel usually more erect than in *distans*, 2–12″ long. Bracts like the leaves and similar to those of *distans*, those of partial umbels narrower, and frequently filiform or awned bracts supporting the spikes, lowest empty glume frequently bract-like with filiform tip. Two lowest glumes very small linear-lanceolate. Stamens 2–3.

Var. **eleusinoides.** Syn. eleusinoides, *Kunth* (and in *F.B.I.*).

This seems to be a mere form of *nutans* with more fascicled denser shorter spikes and with denser umbels. *Clarke* appears to distinguish it by the densely spicate spikelets being 20–40 fld. (but many of the specimens have no more fls. than has *nutans*), colour always grey not reddish, nut narrowly ellipsoid often curved. *Kunth*, however, describes the spikelets as " 8–10-floris dense obsitis, squamis ovato-ellipticis, sub-apice mucronulatis, carinato-navicularibus," and

the nut as obovate-oblong, fuscous, etc., in fact almost exactly as in *nutans*. The type (*Wall.* No. 3346*b*) is a robust plant with several stems from a short rhizome, clothed with leaf-bases. Primary rays of umbel 2–4″, each bearing a very close umbel of grey spikes ·6–·8″ long.

Ranchi, *Clarke*! Hazaribagh, *Clarke*! Monghyr, *Wall.*!

18. C. Thomsoni, *Boeck.*

This is another plant of the *distans* group which has been found in the Sikkim Tarai close to Purneah, and hence is probably in our area.

Rhizome short woody and with general habit of *nutans*. Inflorescence grey shining rather feathery from the close large spikelets having elongated internodes to the rhachilla. The glumes are thus loosely imbricate as in *distans*, but ·18″ long, with 7–9 very close dorsal nerves. Nuts oblong or ellipsoid, only a little over half as long as glume or less, black, top acutely pyramidal.

19. C. malaccensis, *Lam.*

Habit rather various. Rhizome creeping woody and with long stolons under ·2″ diam. clothed with broad lax dark chestnut scales 1″ long. Stems robust, up to 3 ft. sharply 3-quetrous. Umbels large spreading 7–8″ across lax, or rather dense and only 2–3″, simple compound or congested with very long involucral bracts. Spikelets almost terete, glumes up to 14, oblong when unfolded with rounded back and margins incurved all round when dry, ·07–·09″ long. Nut very narrowly oblong, ¾ths length of glume, 3-gonous, ultimately black.

Brackish mud banks, *Clarke*. Sandy tracts, *Walsh*. Puri, *Walsh*!

Stems with concave faces above. L. usually few, erect, ensiform, clothing base of stem with their sheaths, uppermost 2-6″ long. Spikes of 4-10 spikelets ·3-·7″ long linear. Glumes about 11-nerved, with narrow rather coriaceous margins, not keeled, apex rounded; only $\frac{1}{2\frac{1}{2}}$″ long according to *F.B.I.*, but some specimens named by *Clarke* have them nearly ·1″, so that this is probably a mistake.

Prain says "stem terete," but *Lamarck* distinctly states that his *malaccensis* is 3-quetrous and it is often 3-winged at the top. *Walsh's* specimen (named by *Clarke*) is not very characteristic, moreover, the rhachilla is distinctly winged. It is, I think, *tegetiformis*, though *malaccensis* very likely occurs in Cuttack and Puri.

20. C. tegetiformis, *Roxb.*

A robust sedge 1·5–5 ft. high with 3-gonous stems or 3-quetrous at the top not or obscurely septate and long stolons. Leaves hardly any. Bracts short, rarely half the length of the umbel, the rays of which attain 3–5″. Spikelets in short spikes or corymbs, 4–16 together, linear, compressed, ·5–1″ long, glumes closely imbricate, ·1″ long, back with 6–7-nerved keel or rounded and striate with brown and faintly 5–9-nerved ovate-oblong (when unfolded). Rhachilla with linear hyaline wings embracing the ovary. Anthers linear, minutely apiculate or muticous (*Cooke*). Style ·03–·04″. Nut ·05″ oblong, 3-gonous, black. Style ·03–·04″ with stigmas ·05–·08″.

Gaya, *Nusker*! Puri? (see remarks under *malaccensis*). Fl. Oct.

There is only one specimen from our area (Gaya) which has been named in the *Cal. Herb.* and that appears to me doubtful and is possibly *C. corymbosus*. The bracts slightly exceed the umbel and the erect spikelets are very young. Glumes ·11″ long, back with 5 slender nerves, anthers 3 minutely apiculate, wings of rhachilla very obscure, nut undeveloped. Most of the specimens named by *Clarke* are from Lower Bengal and Eastern Bengal. I suspect that the length of the involucral bracts is not a good character, especially in inflorescences of different stages of growth.

21. **C. corymbosus,** *Rottb.*

A robust sedge 2–3 ft. high, stems when dry often more or less septate, obscurely 3-gonous at the top, terete below and attaining ·3″ diam. Leaves on the flowering stems 0 or with a short blade reaching 5″ long terminating a loose sheath, on the young shoots two to three upper sheaths sometimes bearing linear-lanceolate short blades. Bracts ½–¾ length of the umbel or slightly overtopping it, margins often recurved when dry and scabrid. Umbels with very unequal erect or suberect rays, longest rarely 4″ long. Spikelets ·25–1″ long light brown or reddish 4–12 together in short often compound spikes subtended by lanceolate and setaceous bracts. Glumes erect, ovate-oblong (unfolded), ·1–·12″ long, muticous, rounded on the back with a closely 3-nerved centre flanked by brown striæ or finely 10-nerved, margins scarious. Wings of rhachilla usually distinct, oblong (in *Wallich's* no. 3351 nearly ·02″ broad). Nut ·06″ long, narrowly obovoid, 3-gonous, apiculate.

Monghyr, *Ham.*! Singbhum! Hazaribagh, *Clarke*! Fl., Fr. Oct.–Nov.

I have seen no ripe nuts, and suspect that some specimens ascribed to this species are young states of others and that there is no specific difference between this and *tegetiformis*. Rhizome creeping, clothed with dark brown scales and hardening into rhizomes. The new shoots are said to arise on these at some distance from one another as also in the case of *tegetiformis*, whereas in *C. tegetum* there are said to be no stolons and thus the lateral shoots arise from the base of the older ones. Herbarium material is insufficient to check these characters. Anthers 3, muticous and brownish yellow according to *Cooke*, minutely apiculate in specimens (some named by *Clarke*) dissected by myself. Style ·04–·07″, stigmas ·08–·12″.

22. **C. articulatus,** *L.*

A very stout sedge with terete septate stems 3–6 ft. high up to ·8″ diam. at base and stout stolons clothed with ovate-lanceolate striate dark coloured scales ·7″ long. Umbels large, with rays up to 2–6″ long, grey, feathery with dense linear spikelets ·5–1·5″ long, 5–15 together in close spikes, at first straw-coloured. Bracts very short, only ·3–·7″ long, ovate, concave. Glumes imbricate even in fruit, ovate, obtuse, obscurely 3–5-nerved on the back, ·08–·09″ long. Rhachilla very slender wavy with oblong or elliptic scarious wings in the sinuses. Nut oblong-ellipsoid, 3-gonous, acute each end, black, shining, ·05″.

Extending from Bengal to Ceylon, in tanks, etc. No specimens from within our area, though it will probably be found in Cuttack and Puri.

The septa or articulations are well marked when dry.

23. **C. tegetum,** *Roxb.*

A robust rush-like sedge 1·5–4 ft. high with solid green shining stems obtusely 3-angled (trigonous or triquetrous, *Clarke*) above, rising from a creeping woody rhizome ·3″ diam. New shoots ascending close to base of previous ones (*fide Clarke*, but see below; cp. nos. 25 and 26). Leaves sheathing the stem below for about one-third up or less, blades narrow short or fairly long. Spikelets ·7–1·2″ long, brown or red, linear in peduncled spikes which are umbelled or corymbose on the branches of compound umbels 4–12″ diam. which are supported by long bracts. Glumes narrowly oblong (oblong when unfolded), ·08–·12″ long, loosely imbricate especially in fruit, back rounded finely about 10-nerved coloured, margins broad scarious, tip rounded quite muticous. Nut linear-oblong very slightly obovoid, ·06″, brown or grey embraced on each side by the prominent

lanceolate or ovate wings of the rhachilla which separate by a clean cut when ripe.

Chiefly on river banks. Tarai, *Clarke*! Shahabad, *J.D.H.*! Gaya, *Kurz*! Santal Parg.! Ranchi, *Clarke*! Singbhum, common! Hazaribagh, *Clarke*! Manbhum, *Wood*! Probably throughout the whole province. Fl., Fr. Aug. (but usually from Oct.)–Jan.

Rhizome stout and in some of my specimens culms quite 1″ apart. Sheaths much inflated when old.

Leaves above the sheath 0 or 3–9″ long. Inflor. with long foliaceous bracts often one and a half times its length, about ·2–·3″ wide, margins scaberulous, midrib strong. Branches of umbel 1–10″ long suddenly contracted at the corymbs of spikes, branches and peduncles of spikes with short lanceolate finely or setaceously acuminate bracts as well as a short truncate sheath at their base. Glumes sometimes only ·06″ long in flower. Wings of rhachilla about ·04–·05″ long, as long as ovary and usually green in flower, ultimately red or brown. St. 3. Style rather persistent about ·04″, leaving no base on falling, stigmas 3 long and slender, often ·12″ long.

This is a good species for observing that the wings of the rhachilla form no part of the glumes (as stated to be the case by *Cooke*); the glume very clearly embraces the wings and can be moved over the wings.

It is said to be employed in Calcutta for the manufacture of mats.

24. C. pilosus, *Vahl.*

Height 2–3 ft. with stems 3-quetrous above, glabrous below but rhachides of inflorescence closely hispidulous-pubescent. Spikelets (at least when mature) spreading at right angles to rhachis, 3-seriate in loose elongate spikes which are usually in compound umbels, pale brown, lanceolar in outline ·15–·3″ or rarely up to ·5″ long but those on a spike usually constant, the lowest empty glume converted into a setaceous bract of variable length, sometimes exceeding the whole spikelet, other empty glume short hyaline rounded. Fl.-glumes 7–20, ·05–·07″ long broadly ovate (when unfolded) and nearly as broad, rounded or truncate but with a minute mucro from keel. St. 3, anthers muticous. Nut ellipsoid acutely 3-gonous, ·04″ long black, style shorter than nut, stigmas 3.

Common in rice-fields. Ranchi! Manbhum, *Ball*! Hazaribagh, *C.B.C.*! Throughout India according to *F.B.I.* and probably throughout our province. Fl. Sept.–Oct.

Stems often robust and ·4″ diam. at base. Stolons very slender with distant nodes and scales ·25–·3″ long, ultimate rhizome wiry. L. often ⅔ths as long as stem, ·2–·3″ wide. Bracts like the leaves usually far overtopping the umbel ·2–·3″ broad with minutely hispidulous margins. Umbel variable, sometimes a foot across with rays 9″ long, at other times reduced to a single head of spikes. Gl. up to ·08″ in some Ceylon specimens, back rather rounded slightly keeled, striate with red, nerves about 3 each side of keel rather obscure, margin broad white nerveless. Rhachilla compressed with translucent centre, not winged.

A very distinct species from the *nutans* and *tegetum* group, easily recognised by the dense divaricate spikelets, subequal in long cylindrical spikes and small mucronulate glumes with broad scarious margins.

Juncellus serotinus (not found in our area) is so like this as to be indistinguishable, and the two have been collected together at Dharmsala (3500 ft.). The genera are probably entirely artificial.

25. C. babakensis, *Steud.*

This resembles a dense-flowered large-spikeletted form of *pilosus* of which species I would prefer to consider it a variety. *Clarke* describes it as follows: Umbel of few (3–6) rays, lowest ray much longer than the others, erect, stout, secondary umbels condensed into oblong or square dense rigid compound spikes 2″ by 1·5″, rhachis of spikes

scarcely scabrous, never pilose (I would call them hirtellous, as in some *pilosus*), spikelets more robust than in *pilosus*, ·7 by ·12–·17″, 14–40-fld., red brown, rhachilla stout, ·03″ wide, compressed glumes boat-shaped hispid-scabrous at the top of keel, nut hardly ½ glume.

Bhagalpur (near northern boundary), *Ham.*! Fl., Fr. Sept.
Spikelets sometimes only ·25–·55″ long (in some specimens named by *Clarke*), rhachilla deeply excavated. Glumes ·06–·09″ long, mucronulate or minutely cuspidate, same shape as in *pilosus*. Nut elliptic-obovoid black, ·04–·05″ long.

26. C. procerus, *Rottb.*

A yet stouter form of *pilosus* with larger spikelets and glumes, glabrous even on the rhachides (except in var. *lasiorrhachis*) and with relatively much smaller nuts. Secondary umbels loosely corymbed of 1–5 spikes. Spikelets shining remote ·6–1·2″ long, by ·12″ reddish, 20–46-fld. Glumes ·09–·12″ long, with narrow scarious margins. Nut ·04″ long, black, ellipsoid-obovoid, 3-quetrous.

Monghyr, *Griff.* (but specimen very young)! Hazaribagh, *Clarke*! Puri, *Walsh*! See also variety. Fl., Fr. Sept.–Nov.
Stolons elongate, clothed with long acuminate scales, bulbilliferous (*Cooke*). L. very long, often exceeding the stems, ·25–·5″ broad, thickly coriaceous or spongy. Primary rays of umbel 3–7, stout, 1–4″ long. Rhachis of spikes rather stout, angular. Bracts 2–5, sometimes up to 15″ long. St. 3, anthers oblong, muticous. Rhachilla sub-4-gonal, compressed, with the scars margined not winged.

Var. lasiorrhachis, *Clarke.*

Axis of spikes scabrous-pilose.

Ranchi, *Clarke*! Hazaribagh, *Clarke*! elev. 2000 ft.
The spkts. are only about ·6″ long but the glumes are ·1″. Bracts with filiform tips.
According to *Wight*, *C. procerus* is common in rice-field in Madras, grows to be a great height and is used for making mats.

27. C. exaltatus, *Retz.*

A very robust and handsome sedge 3–6 ft. high with obtusely 3-gonous stems, narrow leaves occasionally longer than the stems and compound umbels terminating in very numerous cylindric spikes, many of which are 2″ long or more and ·15–·4″ broad. Spikelets numerous but distinct, usually spreading at right angles from the rhachis ·1–·3″ long or ·5″ after fall of some glumes, often brightly coloured. Glumes ·05–·06″ long, very similar to those of *radiatus*, very acute to minutely aristate. Anthers oblong, not crested. Nut pale ellipsoid ·025″ long, 3-gonous. Style ·03″, stigmas as long.

Santal Parg., *Kurz*! Ranchi (Tamar) *Wood*! Manbhum, *Clarke*! Fl., Fr. Sept.–Nov.
Perhaps not specifically different from *C. radiatus* but different in appearance from the spikelets being distinct especially in the form (*dives*, *Clarke*) with spreading spikelets to which all our specimens belong. Bracts of umbel foliaceous, up to 2 ft. long, ·2–·3″ broad with very broad base. Spkts. with a lanceolate-setaceous bract at their base. Wings very narrow, sometimes appearing continuous on the straight rhachilla and not very conspicuous.

28. C. radiatus, *Vahl.*

A stout sedge 1–3 ft. high leafy below, with leaves often two-thirds as long as stem, ·3″ broad. Umbel simple or compound with digitate

very dense scarcely peduncled cylindric spikes 1″ by ·3″. Spikelets densely erecto-patent ·1–·2″ long, dull-coloured (neither yellow nor red), with very small closely imbricate broad-ovate keeled obtuse glumes ·05″ long without or ·06″ long including the exeurrent mucro or awnlet, back narrowly and finely 3–5-nerved with broad membranous margins. Anthers oblong, not crested. Nut ovoid or ellipsoid, ·025″, 3-gonous, or 2-gonous with back rounded rather than angled. Style hardly any, stigmas 3, very short (perhaps not properly developed in specimen examined).

Santal Parganahs, *Kurz*! Fl., Fr. May.

29. **C. rotundus,** *L.* Batha-bijir, *M.*; Rotesila, *Ho.*; Mutha, *Beng.*

A small or slender sedge with 3-quetrous stems 4″–2 ft. high arising from small hard corms or tubers or bearing tubers on its slender wiry stolons. Leaves rather numerous, mostly radical and generally shorter than the stem, ·1–·12″ broad, ending in a filiform tip. Spikelets light brown shortly spicate on the branches of irregular compound umbels, about 3–8 spikelets in the spike, lanceolate-linear ·25–·75″ or sometimes 1″ (1·5″ *Cooke*) long. Glumes linear-oblong, lower ·12–·16″ long, upper somewhat shorter, rounded but midrib mucronulate. Wings on the rhachilla narrow hyaline continuous with the hyaline margins of the glumes till ripe. Foliaceous bracts at base of inflorescence nearly always 3.

A common weed and growing even on gravel paths in gardens. All districts (probably) though only collected from Singbhum and Palamau inside our area but from many places on the borders. Fl., Fr. July–Dec.

Whole plant glabrous and somewhat glaucous. Primary rays of umbel 3-5″, sometimes 8″ long and frequently compound. Spkts. occasionally 1″ long. Glumes 3-7-nerved on back, rather obscurely. Nut ·06″ long, obovoid trigonous.

The tubers have a pleasant fragrance and are about ·5″ diam., ovoid, black or dark brown outside, white within. They are said to be tonic and also useful in fever, diarrhœa, dysentery and dyspepsia. Cattle eat the leaves.

30. **C. tuberosus,** *Rottb.*

Very like *C. rotundus* and, as *Clarke* says, the difference is perhaps not specific. The woody base of the stems is the best character. It has more slender rays and spikelets and the glumes in fruit are not closely imbricate. The median glumes are about ·1–·15″, edges produced down into the strongly winged rhachilla.

Chilka Lake, *Hooper*! Fl. Aug.–Jan.

The stems in *Hooper's* specimen are 2·5 ft. high, rays of umbel 1-2″.

31. **C. polystachyus,** *Rottb.* Syn. C. subcapitatus, *Clarke.*

This also seems nothing more than a variety of *C. rotundus.* Stems and leaves long and slender, stem at base oblique nodosely thickened then abruptly contracted into a long slender rhizome. The inflorescence is contracted into a close subcapitate umbel with rays 0–·5″ long and appears lateral from the lowest strongest bract being erect and as though a continuation of the stem. Glumes ·1″ long, ferruginus-brown.

Puri, *Barkill*!

2. PYCREUS, *Beauv.*

Very closely allied to *Cyperus* and probably only artificially separated by the two carpels instead of three, the stigmas being two and the nut laterally compressed. The spikelets in all our species have a great superficial resemblance to those of *Eragrostis* among grasses.

A. Nut with longitudinally oblong epidermal cells:—
  Nut not distinctly transversely lineolate. Spkts. under ·1″. broad. Infl. not rayed. Root aromatic . . . . 1. *stramineus.*
  Nut with transverse wavy lines. Spkts. ·15″ broad. Inflor. usually rayed (sometimes reduced to a single head) . . 2. *latespicatus.*
B. Epidermal cells of nut subquadrate hexagonal, sometimes appearing dotted:—
  1. Stems clothed to far above the base with sheaths or leaves. Spkts. ·5-1″ by ·1-·17″ . . . . . 3. *sanguinolentus.*
  2. Stems with leaves only at the base:—
    a. Small tufted annuals. Nut ellipsoid or obovoid:—
      Gl. ·04–·05″ long. St. usually 1 . . . . . 4. *pumilus.*
      Gl. ·08–·09″ long. St. 2 . . . . . 5. *globosus.*
    b. Small tufted perennials:—
      Spkts. ·5-·75″ long. Nut oblong symmetric . . . 6. *odoratus.*
      Spkts. ·6–·8″ long. Nut asymmetric . . . . 7. *sulcinux.*

1. P. stramineus, *C. B. Clarke.* Syn. Cyperus stramineus, *Nees.*

A small tufted very aromatic (at least the root) leafy sedge 6–9″ high with long compressed straw-coloured spikelets ·3″ elongating to 1″ or 1·2″, under ·1″ broad, about 5–12 only in a spike or head, the lower glumes seriatim deciduous leaving a prominently areolate rhachilla in the concavities of which the smooth 2-convex nuts often persist after the glumes fall. Glumes (lower) ·08″ long, mucronate. Spike sometimes with one or two bracts on the rhachis overtopping it.

Throughout the moister parts of India, *Clarke.* The only locality in our area whence I have seen specimens is Jamalpur (Monghyr)! *Prain* says Orissa (*Beng. Pl.*). Fl. Sept.–Nov.

2. P. latespicatus, *C. B. C.* Syn. Cyperus latespicatus, *Boeck.*

Usually larger than last 6–16″ high, spikes more umbellate. Spikelets similar but much broader, ·1–·15″ broad, often chestnut-coloured, often shiny. Rhachilla deeply excavated. Lower glumes ·1″ long. Nut black or blackish-grey, ·03″ long obovoid, beautifully rugulose with transverse wavy lines.

Very common. N. Bengal, *Kurz*! Sarguja, 2500 ft., *Clarke*! Singbhum! Ranchi, *Clarke*! Hazaribagh, *Clarke*, *Anders.*, etc.! Sambalpur, *Griff.*! Fl., Fr. Oct.–Nov.

Usually annual, *Clarke.* L. about half length of stem or 0, ·1-·15″ wide. Glumes ovate-cymbiform, keeled, obtuse, sides scarious and nerveless. Filaments often persistent after glume drops. Under the microscope the epidermis appears composed of longitudinally linear or oblong cells ending in raised lines.

3. P. sanguinolentus, *Nees.* Syn. Cyperus sanguinolentus, *Vahl.*

A tufted rather coarse very leafy sedge 7–8″, or more slender and up to 16″ high, with creeping rhizome. Leaves rarely 0, usually shorter than or as long as the stem, ·1″ wide. Heads or spikes in a short simple umbel or only one. Spikelets linear or oblong-lanceolate clustered (in a head) or shortly spicate, red or reddish, ·5–1″ long by

about ·1–·17″ broad, rhachilla not as deeply excavated as in *stramineus*. Glumes rather loosely imbricate ·06″ or usually ·08–·1″ long, ovate cymbiform, obtuse, nerved on the back. Nut white or brown, ·04″ long smooth, hardly half length of glume, outer cells all subquadrate hexagonal.

Udeypur, *Prain's Collector*! Santal Parg., *Kurz*! Fl. Aug.–Feb.

Stem decumbent at the base, often clothed one-third its length with leaf-sheaths, the leaves thus some distance from the base of the stem. Bracts 3-5 foliaceous, up to 5″ long. Spikelets 6–24-fld. Nut in the Udeypur specimen is almost orbicular but not symmetrical, much compressed. The stems are clothed with short lateral branches each terminating in a head.

4. **P. pumilus,** *nov. comb.* (not of *F.B.I.*). Syn. P. nitens, *Nees*; Cyperus pumilus, *L.*

Short and tufted 1–6″ or laxer and 10″ high. Spikelets pale or somewhat silvery small, clustered or shortly spicate, the head (or spike) solitary or in a simple umbel with a central sessile cluster and 2–6 rays 2–3″ long or less. Glumes very small, ·04–·05″ long, or ·06″ with the cusp, boat-shaped or narrowly oblong mucronate or cuspidate from the excurrent keel. Stamen usually 1 only. Nut somewhat obovoid, brown or grey, ·02″ long.

Monghyr, *Ham.*, *Clarke*! Santal Parg., common, *Kurz*, *Gamble*! Ranchi, *Clarke*, common, etc.! Hazaribagh, *Clarke*! Probably throughout the province. Fl. Sept.–Nov., May. Annual.

L. shorter or as long as the stem, ·05–·1″ broad, weak, 1-nerved, acute. Heads of spkts. ·25–1″ diam. Bracts 3–4 foliaceous up to 4″ long. Spkts. ·17–·6″ long, 20-50-fld., rhachilla slender, persistent. Glumes sometimes 2-fid or -lobed with rounded lobes and with green keel, 3-5-nerved and with rounded hyaline nerveless sides. Stigmas about as long as style. Nut (under high magn.) with longitudinal lines of small isodiametric cells raised in the centre.

It appears to be very closely allied to *Cyperus flavidus*, *Retz.*

5. **P. globosus,** *nov. comb.* Syn. P. capillaris, *Nees*; Cyperus globosus, *All.*

A very slender annual with tufted stems up to 16″ high and very slender almost filiform erect leaves and bracts. Inflorescence often compound with several short rays and a central sessile subglobose spike bearing pale brown to deep brown linear much-compressed spkts. at right angles to the rhachis. Umbels sometimes reduced to a single head. Gl. ·08–·09″. Nut ellipsoid apiculate chestnut-brown to black ·03″.

Ranchi, *Wood*! Hazaribagh, *Clarke*! Also in the Upper Gangetic Plain and extending eastwards so that it probably occurs in all our Northern Tract. Fl. Oct.–Jan., also May (in Tarai). Annual.

Stems 3-gonous. L. 4-12″ weak. Rays of umbel usually very short but attaining 2·5″. Bracts 4–8″. Spkts. variable in length, ·3–·5″ by ·1″ or in some Khasia specimens 1·3″ long by ·12″. Glumes ovate-oblong or ovate-obtuse, closely imbricate. Rhachilla stout 4-gonous. Stamens 2. Stigmas as long as style.

Var. **stricta,** *Clarke*. Spkts. narrower straw-coloured or yellow less compressed frequently short only 6-12-fld., sometimes curved or twisted, gl. closely packed but loosely imbricated. Chota Nagpur, *Clarke*.

6. **P. odoratus,** *Beauv.* Syn. P. polystachyus, *Beauv.*; Cyperus odoratus, *L.*

A very small tufted sedge only 2″ high but often attaining 15″ with very close capitate spikes of radiating spikelets, the umbel simple

rayed or contracted into one head. Spikelets linear many-flowered ·5–·75″ long by ·07–·09″, compressed reddish-brown. Glumes ·08–·1″, closely imbricate, minutely mucronate. Nut oblong, sub-truncate and apiculate.

Puri, *Atkinson*! Fl. May. Perennial.

Stems somewhat thickened at base, 3-gonous. L. overtopping the stem when very short, shorter than the stem when this is elongate, ·12–·17″ broad. Rays of umbel 2–7, ·1–2″ long, each terminated by usually ternate spikes of 4–8 spikelets. Bracts 3–6, spreading, 4–16″ long. St. usually 2. Stigmas as long as the style.

Cooke points out that the name *odoratus* has priority over *polystachyus*. I find no record of the plant being odorous.

7. **P. sulcinux,** *C. B. C.*

A slender plant very closely allied to *P. odoratus*, *Beauv.* but with laxer more compound inflorescence and relatively shorter bracts and the nut is unsymmetric, enlarged or gibbous towards the base, broadly furrowed on each face. Glumes more remote. *Clarke* says that the narrow edge of the nut is much flattened against the rhachilla.

Siliguri and Sikkim Tarai! and probably therefore Purneah. Fl. Sept.-Oct. and May.

Spikelets linear ·3–·8″ or more after fall of lower glumes.

3. JUNCELLUS, *Griseb.*

As in *Cyperus* but nut plano-convex, more or less compressed ventrally, the plane face flat against the rhachilla and stigmas 2. Rhachilla (as in *Pycreus* never winged) persistent. Stamens 3–2 anterior.

Perhaps even more artificial than *Pycreus*, some species, *e.g. J. serotinus*, being indistinguishable from species of *Cyperus* (in this case *C. pilosus*) except in the compressed not equilaterally trigonous nut.

1. **J. pygmæus,** *Clarke.* Syn. Cyperus pygmæus, *Rottb.*

A very tufted small herb 1–4″ (rarely attaining 10″) with dense compound heads ·25–·75″ diam. of linear, often curved or twisted spikelets ·2–·3″ long, greenish-white or finally pale brown. Nut plano-convex, $\frac{1}{3}$–$\frac{1}{2}$ glume.

Purneah (up to 8″ with hds. ·6–·7″ diam.)! Behar (hds. ·4″ diam.), *J.D.H.*! Sandy bank of Ganges, *Wall.*! "Moist shady soil near tanks in Bengal," *Wall.*! Fl. May–Jan.

Leaves long flaccid. Bracts 3–6″. Stamens 2–1, anthers small linear muticous.

4. KYLLINGA, *Rottb.*

Stem leafy below only, terminated by 1–3 sessile capitate ovoid or cylindric dense spikes subtended by leaf-like bracts. Spikelets small compressed of 4–5, rarely more, distichous glumes, rhachilla disarticulating above the two very small lowest glumes. Gl. iii 2-sexual, iv male or empty or rarely 2-sexual, a fifth and occasionally one or two other rudimentary glumes sometimes present. Stamens in fl. glumes 1–3, anterior, anthers muticous or nearly so. Nut laterally compressed, style linear continuous with nut, with 2 linear stigmas.

A. Rhizome very short, stems close, thickened at base:—
Hds. ovoid, 3-nate, centre one ·25–·3″. Gl. iii ·06–·08″ . . 1. *triceps.*
Hds. cylindric, if 3-nate then lateral very small, centre one ·3–·6″ long. Gl. iii ·08″ long . . . . . 2. *cylindrica.*

B. Rhizome creeping, slender, with the stems at intervals:—
Hds. ovoid, rarely 3-nate. Gl. iii not crested . . . . 3. *brevifolia.*
As in *brevifolia*, but gl. iii with a crest on the keel . . . 4. *monocephala.*

1. K. triceps, *Rottb.*

A small plant 3–9″ high, stems thickened at base and tufted on a short thick rootstock. Leaves from one-half to as long as stems, ·12–·17″ wide. Heads usually 3-nate, rarely fewer or 4–5, ovoid or cylindric-ovoid, pale, centre one about ·25″ long, lateral smaller. Gl. iii ovate, ·06–·08″ long, with smooth green slightly excurrent keel, sides 3–4-striate.

Widely distributed from Moradabad to Madras and therefore probably throughout our area. Behar, *Hope*! Hazaribagh, *C.B.C.*! Ganjam, *Fischer*! Fl. July–March.

Bracts under the heads 3–4 unequal, up to 2–3″ long. Spikelets about ·1″ long, straw-coloured. St. usually 2. Nut two-thirds as long as glume, pale brown, ellipsoid, obtuse.

Clarke says that the fertile glume is striate, but I find specimens named by him very strongly nerved just as in *cylindrica* from which it is often scarcely separable.

2. K. cylindrica, *Nees.*

Usually nore slender than the last, stems 4–12″ not much thickened into the short rootstock. Well-named from the shape of the heads which are ·3–·6″ long by about ·17″ broad, sometimes ternate but then the lateral very small. Gl. iii ovate, ·08–·1″ long, keel green scarcely excurrent, sides strongly nerved.

Parasnath, *Anders.*! Fl. Sept.

L. as in *triceps*, but usually shorter than the stems. Bracts 2-several, usually 2–3. Spkts. ·1–·17″ long, straw-coloured. Nut as in *triceps* (finally black, *C.B.C.*).

3. K. brevifolia, *Rottb.*

Height usually 6–20″, several stems erect from a slender creeping rhizome clothed with large brown imbricating scales. Leaves few erect 1–3″ or sometimes exceeding the stem (*Clarke*), ·07–·17″ broad, glabrous or scabrid, especially at the tips. Heads usually solitary ·25–·3″ long, subtended by 3–4 foliaceous bracts 1–4″ long. Glumes green or brownish, lowest 2 very minute, iii 2-sexual ovate with green mucronate keel and scarious sides with 4–6 lateral nerves each side (2 very close to midrib). Nut ellipsoid compressed yellowish or yellow brown, gl. iv, ·12″, male or empty.

Singbhum! Hazaribagh, *Clarke*! Throughout India, *Clarke*! Fl. May.–Oct.

Rhizome under ·1″ diam. Bracts often hispid on the margins. Heads sometimes 3. Fl. glume scabrous on lower part of keel, less so or smooth above. St. 3 or 2. Nut ½ to ⅔ as long as glume, ellipsoid obtuse, style ½ as long as nut. Minute red glands are frequent especially on the sheaths, but *Clarke* states that the fl.-glume is always eglandular.

4. K. monocephala, *Rottb.*

Very similar in appearance to *brevifolia* and with the same creeping rhizome and scattered stems. Tips of leaves also sometimes scabrid as in *brevifolia* and minute red glands frequent in both. It differs however in the upper part of the keel of the fruiting glume being furnished with a wing or crest with scattered small red glands.

Wide-spread from the United Provinces to Bengal and therefore almost certainly within our area. Fl. July–March.

It is often mixed on same sheets as *brevifolia* and does not appear to me to be more than a variety of that species.

5. MARISCUS, *Vahl.*

Usually perennial herbs with grass-like leaves and bracts. Spikelets laterally compressed or quite terete with the glumes 2-seriate (distichous) or slightly spiral, lowest 2 always empty, smaller than the others, usually persistent or separately deciduous after the rest of the spkt. has fallen, next 1–2 glumes also sometimes empty, occasionally only 1–3 glumes flowering and 2-sexual but more often more and up to 12. Rhachilla disarticulate above the two lowest glumes leaving a small knob or disc with sometimes an annular ridge on the top. Stamens 3 (in all plants seen by me). Nut usually oblong and somewhat wider upwards more rarely ovoid or obovoid, sometimes slightly curved and asymmetric. Stigmas 3 slender.

Mariscus is united with *Cyperus* by some botanists. It seems to me usually amply distinct and (as in the case of *M. dilutus*) to make a transition to the Rhynchosporeæ. The only species likely to give rise to confusion in our area are *Cyperus aristatus* and *M. squarrosus*, but in this case it seems that the *Cyperus* is nearer *Mariscus*.

I. Umbels contracted into a single ovoid dense head :—
  Spkts. bearing 2–6 nuts . . . . . 1. *Dregeanus.*
II. Umbels not contracted into dense heads :—
  A. Spikelets short in linear cylindric or oblong spikes :—
    1. Umbels simple :—
      a. Spikes cylindric narrow sessile or peduncled. Spkts. bearing 1–2 (very rarely 3) nuts :—
        Stolons slender. Fruiting spkts. suberect slender acuminate ·2″ . . . . . 2. *tenuifolius.*
        Stolons 0. Fruiting spkts. divaricate subfusiform ·15″ . . . . . 3. *Sieberianus.*
      b. Spikes short subquadrate. Spkts. bearing 4 or more nuts :—
        Spkts. divaricate. Glumes aristate . . . . . 4. *squarrosus.*
    2. Umbels compound. Robust herbs with broad leaves :—
      Spikes cylindric or ovoid. Spkts. with 3-6 nuts. Glumes obtuse . . . . . 5. *albescens.*
  B. Spikelets linear in globose spikes or heads. Heads in compound or decompound umbels . . . . . 6. *compactus.*

1. M. Dregeanus, *Kunth.*

A cæspitose sedge 1·2 ft. high without stolons and the spikelets congested into a single terminal head ·3–·6″ long and broad, each spikelet ovoid to linear ·2–·3″ long bearing 2–6 nuts. Glumes above the two persistent lowest ·12–·15″ many-striate. Nuts linear black 3-quetrous ·08″ (oblong or somewhat obovoid, *Clarke*).

Messrs. Narayanswami and *Carter* refer to a *Mariscus sp. nov.* allied to *M. Dregeanus* but to which they give no name. They state that it differs in having nuts in all the spikelets, which are usually compressed and longer than those of *Dregeanus*. The fl. glumes are boat-shaped and not ovate.

Island of Barkuda in the Chilka Lake, rare (*Memoirs As. Soc. Beng.*). I have not seen it.

Base of stem in *M. Dregeanus* oblong thickened by the turgid membranous coloured sheaths.

2. M. tenuifolius, *Schrad.*

A very slender plant with very slender stolons, base covered with fibrous sheaths. Leaves slender or filiform (in the Monghyr specimen) and bracts similar. Spikes cylindric ·3–1″ long solitary on the rays which are 0–1″ long in a simple contracted umbel supported by bracts

3–6″ long. Spikelets ·2″ slender acuminate dusky-green, ultimately suberect, with 2 small glumes ·02–·03″ long at the base and usually 2 nut-bearing glumes.

Monghyr, *Wall.*!
Clarke throws doubt on this having come from Monghyr.

3. **M. Sieberianus,** *Nees.* Syn. Cyperus umbellatus, *Miq.*

Rather slender grass-like sedge 18–30″ high with several stems uniseriate on a short creeping rhizome covered with the remains of old leaf-sheaths. Spikelets closely spirally arranged in cylindric pedunculate spikes ·7–2·3″ long (including the peduncle) in a simple terminal umbel with 3–5 larger lower foliaceous bracts and 2–5 more slender or setaceous bracts, the lower ones far exceeding the umbel, the narrower ones slightly so. Spikelets erecto-patent in flower linear-subulate ·13″ long, in fruit spreading at right angles to the rhachis, semifusiform, ·15″ long, deciduous, leaving the bract-like lower glume and the other small empty glume on the annular scar or these separately deciduous. Fruiting spkt. after falling consists of 2 subequal glumes, outer lanceolate-oblong muticous many-nerved, inner cymbiform with curved keel prolonged into an awn and with broad hyaline sides. Nut brown ·08″, curved-oblong, 3-quetrous. Style ¾ths nut, stigmas longer.

Usually found on somewhat high ground but in the rains. Frequent. Purneah! Singbhum! Hazaribagh (on Parasnath) *J.D.H.*! It is very common eastwards of our area. Fl., Fr. Aug.–Sept.

Leaves often as long as or exceeding stem, ·12–·17″ broad. Rays of umbel or spikes simple (but see variety), straight, peduncle sometimes longer than spike in fruit. Spkts. in flower usually (typically) with only 4 glumes: i small lanceolate-acuminate or setaceous bract-like ·05″ or less, ii empty half-convolute, truncate ·06″, base amplexicaul, iii ·12″ (or whole length of spkt.), very convolute, linear-oblong (when unrolled), iv present in a very small hyaline state and embracing the young 2-sexual flower. It has a short incurved very acute or mucronate tip, st. 3. In *Clarke's* variety *evolutior* there are more flowering glumes and the spikelets bear 2–4 nuts. In var. *subcomposita* the spikes are often digitate on the rays. Neither of these varieties have been seen in our area.

4. **M. squarrosus,** *C. B. Clarke.*

This is a small plant closely resembling *Cyperus aristatus Rottb.*, and as it extends from Bengal to Ceylon is very likely to be found in Orissa. The stems are not winged as in the *Cyperus*, spikelets about ·2″ and glumes ·05–·07″, the awn less recurved than in *C. aristatus*. The nuts are linear ·04″ long which is nearly twice the length of those of the *Cyperus*. This latter, however, in the button-shaped scars after fall of the spikelets is practically a *Mariscus* but the lowest glumes are not persistent below the articulation.

5. **M. albescens,** *Gaud.*

A stout species 1–3 ft. high with long leaves often as long as stem, up to ·35″ broad. Spikes 1–1·5″ long, in a dense corymb (compound umbel) with numerous spreading oblong hardly compressed close spikelets ·2–·25″ long. Glumes about 8, flowering about ·1″ long, slightly concave, 9-nerved, obtuse. Rhachis after fall of the spkts. stout angled, with the 1–2 persistent lanceolate basal glumes below the prominent scars of the articulate rhachilla. Nuts 3–6 to a spikelet, short, broad, ovoid.

Barkuda, Chilka Lake. "Between rocks in water near the edge of ponds. Plants 3 ft. high. Fl. mainly June-Oct., but also in April when the rocks are quite dry." *Narayanswami* and *Carter* (*Memoirs As. Soc.*, vii, 4).
Leaves transversely lineolate, *Clarke*.

6. **M. compactus,** *nov. comb.* Syn. Cyperus compactus, *Retz.* (Obs. v, 10); M. microcephalus, *Presl.*; Cyperus dilutus, *Vahl* (1805–06).

Rhizome short stout covered with old remains of sheaths and short leaves and bearing two or three stems 8″–3 ft. high, their bases clothed with very characteristic large oblong-celled spongy leaf-sheaths. Easily recognised by the numerous straight subulate spikelets aggregated into brown globose heads (contracted spikes) ·5–·75″ diam., the heads on the rays of compound umbels 2–12″ diam. Glumes imbricate much convolute, often 3–4 lowest empty so that when, as is sometimes the case, there are only two or three 2-sexual glumes this might be taken for a *Schœnus* or *Cladium*. In other cases however there are as many as 14 fruiting glumes. Nuts narrowly oblong slightly wider upwards (narrowly obovoid, *Clarke*), ·7″ long, 3-angled, usually slightly curved on one side, tip beaked with the base of the style. Rhachilla slender with narrow hyaline persistent wings.

In rice-fields, common. Purneah and western Bengal, *Kurz*! Ranchi, *Clarke*! Singbhum! Also in Upper Gangetic Plain and eastern and lower Bengal, so that it probably occurs in all districts. Fl., Fr. Aug.–Nov.
L. nearly or as long as stem. Bracts usually about 3, very long and about ·2″ broad, others shorter, with large-celled tissue at their base like the leaves. Peduncles of heads with a bract at base as well as a tubular sheath, rhachis attaining about ·2″ long in fruit and covered with the lowest pairs of glumes after fall of the spkts. and their very prominent knob-like bases. Spkts. not compressed and the convolute glumes slightly spirally arranged, lowest 2 empty small ·03″. iii about ·06–·08″ also often empty, ovate-lanceolate, about 5-nerved, iv usually flowering convolute ·12–·15″ linear-oblong obtuse, closely 3-4-nerved along centre and remainder scarious coriaceous. iv and v similar, the rest either male or tabescent or up to 14 altogether flowering. Ovary minute, style three times as long passing gradually into ovary, stigmas long. St. 3, anths. apiculate. Rhachilla with long internodes so that each glume only embraces about half he following.
Cyperus compactus, *Retz.* (1779–91) is given as a synonymn by *Kunth* and is th oldest name. *Retzius'* plant came from China but our plant also extends into China. It is described as having terete culms, but the rest of the description agrees fairly well.

6. COURTOISIA, *Nees.*

Herbs with erect simple stems and grass-like leaves only near the base. Spikelets compressed in umbelled globose spikes, very often with the lowest glumes in a different plane from the succeeding ones and occasionally with abortive rudimentary spikelets in their axils, usually 2 lowest empty, 1–3 succeeding 2-sexual and nut-bearing and always winged on the keel, uppermost sterile. Rhachilla disarticulating above the empty glumes. Stamens 3 with oblong anthers. Style short persistent with 3 long stigmas. Nut 3-gonous acute.

1. C. cyperoides, *Nees.*

Stems 1·5–2 ft. high, clustered, 3-quetrous. Leaves very long, flaccid, under ·25″ broad. Inflorescence corymbiform with several

long unequal rays 1–4·5″ long, and a central sessile head, the longer rays often compound, ultimately bearing many globose or sub-globose heads ·3–·5″ diam. consisting of numerous short congested spikes bearing many scarious bracts and few-fld. spikelets. Spikelets mostly with a lower empty cymbiform bract ·12″ long and a narrower muticous bract ·06″ long at their base, often resembling glumes but in other cases in a different plane and bearing rudimentary spkts. in their axils. Flowering glumes 2, rarely more, usually only 1 nut-bearing boat-shaped with prominently winged keels and broad sides, ·15–·18″ long, subequal or one rather longer and with a more prominent cusp. Nut narrowly fusiform beaked, 3-quetrous, ·12″ long, embraced by the glumes.

N. Bengal (Purneah?), *Kurz*! Ranchi, *Gamble*! Hazaribagh, *T. Anders.*! Singbhum, chiefly in rice-fields, frequent! Fl., Fr. Oct.–Feb. Annual.

7. ELEOCHARIS, *R. Br.*

Stems simple erect, non-flowering stems sometimes leaf-like, but of same form as the flowering. Leaves reduced to a few cylindric usually membranous sheaths at the base of the stems, usually truncate, sometimes with a small tooth or minute blade. Inflorescence a single (rarely more) terminal spikelet supported by a short bract which occasionally bears a flower and never exceeds the spikelet. Glumes several to many, imbricate on all sides, obtuse. Lowest flower perfect nut-bearing, several succeeding glumes usually nut-bearing, upper tabescent. Bristles 8–5, rarely fewer (often small or 0 in *atropurpurea*). Stamens 3–1, anterior; anthers linear-oblong, not crested. Style-base dilated and apparently articulate (usually sharply constricted between nut and the style base), but persistent. Nut more or less obovoid plano-convex when stigmas are 2, or 3-gonous when stigmas are 3 on the linear style.

I. Stems 1-3 ft. high, ·15–·25′ diam. Spkts. scarcely wider than the stem. Gl. ·2–·3″ long. Stigmas 2 or 3:—
  Stems septate. Nut not distinctly striate . . . . 1. *plantaginea*.
  Stems not septate. Nut cancellate* . . . . . 2. *fistulosa*.
II. Stems slender, mostly under 12″ high under ·1″ diam. Spkts. wider than stem. Gl. under ·2″ (rarely more in 3):—
  A. Stigmas 2. Nut biconvex:—
    1. Nut (with style base) ·06–·08″, style base large conical:—
      Stems 4–20″. Gl. ·18–·2″ . . . . . 3. *palustris*.
    2. Nut ·03″, style-base very small depressed or disciform:—
      Stems 2–14′. Spkts. ·12–·5″. Bristles brown . . 4. *capitata*.
      Stems 2–7″. Spkt. ·1–·25″. Bristles shining white . 5. *atropurpurea*.
  B. Stigmas 3. Nut 3-quetrous or 3-gonous:—
    Stems 1–2′, angled. Spkt. ·05–·15″ . . . . . 6. *chætaria*.
    Stems 8–12″, fluted. Spkts. ·2–·3″ . . . . . 7. *congesta*.

1. E. plantaginea, *R. Br.*

A rush-like cæspitose sedge 1–3 ft. high with terete tough stems ·17–·2″ diam. distantly obscurely septate when dry terminated by

* Outer cells subquadrate in vertical series, their walls causing the nut to be vertically and horizontally striate.

single brownish spikelets ·7–1·2″ long and about same diameter as the stem, embraced at the base by a very short rounded scarious margined bract appearing as a continuation of the stem. Glumes closely imbricate, ·2–·3″ long broadly oblong to somewhat ovate or obovate, tip always rounded and with a thin scarious margin, back closely striate and sometimes with a faint keel. Bristles 7–8 about as long as the nut (excluding the pyramidal style-base), retrorsely hispid. Nut light brown polished smooth about one-third as long as glume, biconvex or obscurely 3-gonous according as the stigmas are 2 or 3, tipped with the persistent conical articulate base of the style which is two-thirds to three-fourths as long as the nut. Style very long.

Monghyr, *Ham.*! Hazaribagh, *Clarke*! Gregarious in shallow tanks from the Sikkim Tarai! to Raipur (in the Central Provinces outside our S.W. district)! also in Bengal proper, so that it will probably be found in other districts within our area. Fl., Fr. Oct.–Dec.

Stolons long ·12–·17″ diam. Sheaths at base of stems 2-8″ long, thin and torn. Rhachilla after fall of glumes stout with deep depressions and marked ledges (on which the nut rested).

2. **E. fistulosa,** *Schultes.*

Habit of the last but stems triquetrous at the top and not transversely septate when dry, spikelets about the same size but more acute and the tips of the glumes less closely appressed, nut distinctly longitudinally striate and more minutely transversely striate from the superficial transversely-oblong cells being arranged in vertical series.

Same situations as *E. plantaginea* and sometimes growing intimately associated with it so that with one hand one may collect several culms of both species. Jalpaiguri, probably therefore Purneah! Jumalpur (Monghyr Dist.), *Kew Herb.*! Ranchi, *Clarke*! Fl., Fr. Oct.–Dec.

The sheaths and the shape of the glumes are much the same as in *E. plantaginea* but the rhachilla is somewhat slighter, less deeply excavate and often with membranous appendages (remains of the glumes?) after fall of the glumes.

3. **E. palustris,** *Br.*

A rather slender cæspitose sedge with creeping rhizome black or dark brown. Stems 4–20″ high up to ·12″ diam. (rarely ·1″ in our area) terminated by an ellipsoid or cylindric dense-fld. yellow or brownish spikelet wider than the stem ·3–1″ long and ·15–·2″ broad. Glumes much imbricate long, boat-shaped with green keel and hyaline or coloured margins, lanceolate when unfolded, ·18–·22″ long, obtuse. Nut including the large style-base ·06–·08″ long, biconvex, obovoid rounded and very broad, style-base nearly half as long as nut ovoid or broadly conical.

Shahabad, *Ramajad Lal*! Also in Lower Bengal, so that it will probably be found in the intermediate plains districts. Fl., Fr. Dec.–March.

Stems with loose often red leaf-sheaths below, the uppermost sometimes produced on one side into a triangular point otherwise truncate. Stem with a terminal small glume-like bract supporting the spikelet oblong green with broad scarious margins. Bristles 6 as long as or exceeding the nut, retrorsely scabrous (sometimes reduced in both number and length, *Clarke*). *Clarke* speaks of the nut being much narrowed at the top, sometimes to a very short beak; it is rounded at the top in specimens seen by me. Outer cells obscure, rarely reticulate.

The plant is cosmopolitan and is common in the British Islands where the nut is usually striate.

4. **E. capitata,** *Br.*

Perhaps not specifically distinct from *E. atropurpurea* but stouter and attains 14″; small specimens are only separated by *Clarke* from the bristles being brown or ferruginous instead of white. The glumes also appear to be less folded but merely concave and broadly elliptic or ell.-oblong. The spikelets are said to attain ·5″. Nut deep brown or black as in *atropurpura*.

Near rivulets, *Kurz*! Hot springs of Saruchkund, Plains of Bihar, *Kew Herb.*! Hazaribagh, *Anders.*! Manbhum, *Ball*! Singbhum, *Clarke*! Fl., Fr. Sept.–Dec.

6. **E. atropurpurea,** *Kunth.* Syn. Scirpus capitatus.

A small weak cæspitose sedge 2–7″ high. Stems slender terminating in a single small ovoid or sub-cylindric spikelet ·1–·25″ long. Glumes ·05–·06″ long at base of spikelet, broadly-oblong obtuse or rounded at tip, membranous, folded, 3-nerved. Bristles about 6 as long as nut, glistening white. Nut brown (black, *Clarke*), polished microscopically striate obovoid, biconvex, ·03″ long, crowned with the disciform style-base. Style 2-fid.

In dried up pools, etc. Purneah, *Ham.*! Monghyr, *Griff.*! Western Bengal and Bihar (Manbhum), *Kurz*! Hazaribagh, *Anders., Clarke*! Singbhum! Fl., Fr. April–Dec. Annual.

6. **E. chætaria,** *Roem. & Sch.*

A very small tufted sedge 1–2″ high, occasionally up to 6″, sometimes with a short filiform rhizome. Stems slender, angled, terminated by a short ovoid or ellipsoid few-fld. spikelet ·05–·15″ long. Glumes, lower sub-distichous ·1″ long, boat-shaped with broad coloured and scarious sides, upper spiral smaller. Nut ·05″ long, distinctly 3-quetrous, rounded between the prominent angles and distinctly punctulate in vertical lines (cancellate, outer cells in each face in 6–10 series, sometimes perforated, *Clarke*).

In half-wet swamps and rice-fields. Sikkim Tarai (near Purneah), *King, Kurz.*! Ranchi, *Clarke*! Singbhum! Probably in many other districts. Fl., Fr. Sept.–Dec. Probably annual.

Uppermost stem-sheath often with 1 or sometimes 2 scarious elliptic blades ·04–·05″ long. Spikelets with few glumes, only 1–4 developing nuts. Stigmas 3. Angles of nut often slightly produced at its shoulder, style-base short conical. The nut apart from the style base and thick receptacular base is cylindrico-globose.

7. **E. congesta,** *Don.*

A cæspitose sedge 8–12″ high with slender nearly terete 8–10-fluted or -striate stems and a terminal many-glumed ovoid or conical spikelet ·2–·3″ long frequently with subsidiary branches from the axil of the bract which may bear a smaller spikelet. Glumes ·08″ ell.-oblong concave, not keeled, hyaline in centre and with often coloured margins or a coloured band between the centre and margins, midrib very fine. Stigmas 3 longer than the short style. Nut straw-coloured ·05″ without or ·06″ with the narrow-conical style-base, obovoid or pyriform obscurely 3-angled. Bristles rather stout a little longer than nut, retrorsely scabrous.

In the hills of Chota Nagpur, over 2000 ft. Ranchi, *Clarke*! Sirguja, *Clarke*! Tributary States of Chota Nagpur (without precise loc.), *Prain's Collector*! Fl. Fr. Oct.–Dec.

Lower sheaths often reddish, uppermost with a short subulate or lanceolate appendage. Branches of inflorescence when present shorter or longer than the spikelet with a sheath round their base. There is a short neck between the nut proper and the style-base (which latter *Clarke* describes as bulbiform!), and the species appears almost inseparable from *E. subcivipara, Boeck*, except by habit. The latter has very slender flexile stems and small heads.

8. FIMBRISTYLIS, *Vahl.*

Usually tufted sedges with short woody rootstock or fibrous roots, not stoloniferous. Leaves usually near base of stem, rarely 0. Spikelets 1–many clustered or discrete, umbellate when numerous, many flowered with all the glumes imbricate or in a few lower distichous. Lowest 1–2 rarely 3 glumes empty, several succeeding with 2-sexual flowers, upper tabescent. Stamens 3–1, anterior. Bristles 0. Style usually more or less pubescent or hairy, its base dilated and constricted below the dilatation, deciduous altogether or persistent, stigmas 3–2. Nut usually obovoid, often with a foot or gynophore (much dilated in *F. podocarpa*).

The glumes in this genus are much more variable in size than in *Cyperus*.

The length of the spikelets in the following key is the length before the fall of the lower glumes; the spikelet continues to elongate after the fall of the lower glumes, though the glumaceous part often remains fairly uniform in length.

I. Stigmas 3, nut usually 3-gonous, rarely compressed. Style sometimes glabrous:—
  A. All glumes spirally imbricate. Spkts. mostly small:—
    1. Spikelets discrete (not sessile in clusters), many, in compound umbels:—
      Spkts. subglobose under ·1″. Gl. ·04–·05″ . . . 1. *miliacea.*
      Spkts. ellipsoid acute, over ·1″. Gl. ·06″ . . . 2. *quinquangularis.*
      Spkts. lanceolate ·17–·25″. Gl. ·08–·1″. Stems flat above . . . . . 3. *complanata.*
      Spkts. ellipsoid ·2–·3″. Gl. ·1–·16″. Rhizome stout . 4. *Thomsoni.*
    2. Spkts. sessile in clusters, clusters umbelled:—
      Spkts. ·15–·25″. Gl. ·15–·16″. Rhizome stout. L. 2–5″ . . . . . 5. *junciformis.*
  B. Lower glumes distichous or sub-distichous. Spkts. discrete or solitary, usually large:—
    1. Umbels compound. Spkts. ·3″. Umbels with short hairy bracts . . . . . 6. *fusca.*
    2. Spkts. one only or few in the umbel:—
      Spkts. 5-9 in the umbel, ·15–·3″. Gl. ·06–·08″ . . 7. *tenera.*
      Spkts. solitary (rarely 2-3) on the stem, ·3–·5″ . . 8. *monostachya.*
II. Stigmas 2, nut narrow or biconvex. Style much compressed, nearly always hairy above or below. Glumes imbricate spiral:—
  A. Spkts. one only or few (rarely up to 6) in the umbel, mostly large:—
    1. Spkts. only one on the stem. Stem obscurely 4-angular, leafless or nearly so:—
      Spkts. ·25–·4″. Nut linear-oblong . . . . 9. *tetragona.*
      Spkts. ·2–·35″. Nut sub-globose, transversely fluted 10. *acuminata.*
    2. Spkts. 1-3 (rarely 6). Stem not 4-angular. Leafy:—
      Spkts. ovoid ·3–·7″. Nut stipitate . . . . 11. *schœnoides.*
      Spkts. linear-oblong ·5–·7″, usually 1-2 sessile and 1 ray . . . . . 12. *subbispicata.*
  B. Spkts. many (1 only in *diphylla var.* sometimes few in *ferruginea*) umbelled, usually small:—
    1. Glumes discrete (sub-clustered in *spathacea*):—
      a. Glumes with awn as long as the blade (exc. sometimes *æstivalis*). Small very tufted often pubescent herbs:—

i. Spkts. subglobose or oblong, awns squarrose:—
Nut linear cylindric . . . . . 13. *dipsacea.*
Nut orbicular-obovoid. Style-base with pendulous hairs . . . . . 14. *squarrosa.*
ii. Spkts. narrow, awns not squarrose. Style minutely hairy at the base . . . . 15. *æstivalis.*
b. Glumes muticous or keel only very slightly excurrent (awned in the lowest glumes of *æstivalis*):—
i. Hairy or pubescent all over. Lower gl. awned 15. *æstivalis.*
ii. Mostly glabrous (L. sometimes hairy in *ferruginea*, sheaths and bracts sometimes hairy in *diphylla*):—
† Nut with large gynophore, minutely many-striate . . . . . 16. *podocarpa.*
†† Nut with very minute or 0 gynophore:—
† Leaves long (often as long as stem):—
Spkts. not angled by the prominent keel of the glumes . . . . . 17. *diphylla.*
Spkts. angled by the prominent keels of the glumes . . . . . 18. *dichotoma.*
†† Leaves very short compared with the stems:—
Spkts. ovoid ·2–·4″. Gl. ·12″, hoary above. Nut pale . . . . . 19. *ferruginea.*
Spkts. often congested, cylindric ·1–·15″. Gl. ·06″, rounded. Nut black . . . 20. *spathacea.*
2. Spkts. sessile in clusters:—
a. Heads solitary on the stems. Spkts. ·2″, ovoid or lanceolar . . . . . 21. *argentea.*
b. Clusters umbelled:—
L. long, not silky. Spkts. narrowly linear ·4–·6″ 22. *Hookeriana.*
L. short, silvery silky. Spkts. ellipsoid-oblong . 23. *sericea.*

1. F. miliacea, *Vahl.*

Cæspitose, usually 1–2·5 ft. high. Stems angled or almost winged above embraced at base by the large leaf-sheaths. Leaves usually well developed and frequently as long as stem, ·07–·2″ broad, many-nerved. Branches of umbel often strongly 3-quetrous and scabrid. Spikelets very many in decompound umbels 1–6″ diam., sub-globose, ·08″ long, usually one central sessile and 2–5 lateral with slender pedicels on the final branches of the umbel. Glumes ·04–·05″ long, ovate-cymbiform, keel scarcely excurrent or submucronate. Nut obovoid 3-gonous, ·02–·025″ long, minutely transversely striate (with transversely elongate cells) and often minutely verrucose, pale straw-coloured. Style about equal to nut with pyramidal base, scantily pubescent near the 3 stigmas.

Rice-fields, etc., common. Chota Nagpur, *Wood*! Singbhum! Hazaribagh, *Clarke*! Probably in all districts. Fl., Fr. r.s. and c.s.

Clarke says hardly separable from *quinquangularis*, but it appears to me very distinct. The rhachilla is nearly or quite naked after the fall of the glumes or the scales are very inconspicuous; one empty narrowly lanceolate glume-like bract is, however, sometimes persistent at the base. The glumes have a pale midrib and a dark brown streak each side of it and lighter brown sides almost exactly as in *quinquangularis.*

2. F. quinquangularis, *Kunth.*

Cæspitose with many angular stems usually 1–2 ft. high, sometimes flattened at the base, rarely leafless. Leaves usually half to as long as stem, many-nerved, ·05–·07″ broad, rarely leafless. Spikelets very

numerous, small, ellipsoid or oblong-lanceolate, more or less pointed ·1–·2″ long on capillary pedicles in rather compact decompound umbels 1–6″ diam. Gl. ·06″ long, ovately cymbiform with keel slightly produced into a mucro. Nut globosely obovoid ·02″ long minutely cancellate with very short but transversely elongate cells and verrucose when old, very minutely apiculate after fall of the style. Style not conspicuously flattened, a little longer than nut, only pubescent near the 3 stigmas which are nearly as long.

Common in rice-fields. Santal Parg., *Kurz*! Ranchi! Singbhum! Manbhum, *Clarke*! Hazaribagh, *Clarke*! also on Parasnath 3000 ft.! Fl., Fr. Oct.–Jan.

As in most *Fimbristylis* scales are left on the rhachilla after the fall of the glumes, the morphology of which is not clear to me. They are very marked in this species, are brown and lanceolate and ·02″ long. They appear to form no part of the glumes but are rather in the nature of bracteoles.

3. F. complanata, *Link*.

Stems 8″–2 ft. flattened above. Leaves numerous often 4–8″ long, ·12–·22″ broad, almost premorse. Umbels large usually very compound 2–4″ diam. with brown lanceolar angled spikelets ·17–·25″ elongating to ·3″ after fall of lower glumes. Bracts broad very obtuse like the leaves, always much shorter than the umbel, ·5–1·5″ by ·1″. Glumes ·08–·1″ with the 3-nerved keel of lower glumes excurrent as a fine point. Nut ·02″ long white obovoid obtuse tubercled.

Several times collected in Bengal without specific locality and also in the United Provinces and the Peninsula. It probably therefore occurs in our Area although I have seen no specimens certainly collected there. *Clarke* states that it occurs throughout India. Fl., Fr. May–Sept.

4. F. Thomsonii, *Boeck*.

Stems 8″–2 ft. obscurely angular or compressed above, base often densely clothed with leaf bases on a thickened stock. Leaves short 2–4″ or up to 12″, obtuse, ·1″ broad. Spikelets large ·2–·3″ long (or ·4″, *Clarke*), ellipsoid or oblong-lanceolar, discrete in compound and decompound umbels, angled, with an empty aristate glume or bract at the base ·15″ long, the awn hispid. Lowest flowering glume also shortly awned and slightly hispid on keel. Other fl. glumes ·1–·16″ long, cymbiform with keel very shortly excurrent. St. 3. Ovary linear with very large pyramidal style base, style (with base) ·06–·07″ glabrous (or nearly so), arms nearly as long, minutely pubescent. Nut pyriform-obovoid, obtusely 3-gonous, ·04–·06″ long, obscurely, transversely lineolate, verrucose.

Hazaribagh (on Parasnath, 4200 ft.) *Clarke*! Fl., Fr. April.

I doubt whether this is anything more than *F. junciformis* with discrete spikelets though the style-base is much broader than I have seen it in that species. The Hazaribagh specimen (named by *Clarke*) has the thick stock, leaves and bracts much as I have described under *junciformis*.

5. F. junciformis, *Kunth*.

Stems 8–18″ obscurely angular or somewhat compressed, usually densely leafy at the base and arising from a stout thick rootstock sometimes ·5″ diam. Leaves usually short 2–5″ long (or sometimes two-thirds as long as stems, *Clarke*), ·05–·12″ broad, obtuse, margins incurved or not. Spikelets ·15–·25″ long, always some clustered,

terminal ones sometimes solitary, in compound and decompound umbels 1–3″ diam. (umbels usually longer than broad). Glumes usually with an empty aristate glume or bract at the base and clusters also supported by an aristate bract. Lowest fl. glumes often with excurrent keel, other fl. glumes ·15–·16″ long, cymbiform, chestnut-brown with narrow scarious margins, keel very shortly or not excurrent. St. 3 with linear apiculate anthers. Ovary with pyramidal style base, style ·07–·1″ long glabrous (or nearly so), stigmas ⅔ths as long or more, minutely pubescent. Nut obovoid, 3-gonous, ·04″ long, minutely verrucose.

Monghyr, *Ham.*! Chota Nagpur, chiefly on the plateaux. Sandy places, Manbhum, *Kurz*. Dry grassy places in Ranchi! Palamau! Chota Nagpur, *Wood* (without district)! Fl., Fr. May–Sept. Perennial.

Rootstock woody, clothed by the brown dilated bases of the leaf-sheaths.

L. usually with minutely hispidulous margins at base. Umbels with one to three principal bracts ·5–1″ long with broad amplexicaul many-nerved dry sheaths and frequently scabrid blade. Branches of umbel much striate and often compressed.

The plant is well named, the brown tufted spikelets reminding one much of a Juncus. It is usually burnt annually by jungle fires and shoots up after these have passed over the ground.

6. F. fusca, *Benth.*

Rootstock stout. Stems tall slender 8–18″ with a tuft of leaves 2–6″ long, ·06″ broad, at the base. Spikelets discrete brown oblong ·3″ in rather lax mostly compound umbels 1–2·5″ diam. with usually hairy short bracts ·3–·7″ long. Glumes ·17–·2″ long, lower 3 empty and 2–6 nut-bearing distichous or nearly so, upper 3–6 male or sterile 3–few-ranked, narrow-lanceolate, few-nerved, keeled, all shortly awned or mucronate, margins pale. Stigmas 3. Nut obovoid pale ·04″ long minutely verrucose.

Manbhum (Barakar) in sandy thickets, *Kurz*! Fl. May.

7. F. tenera, *Roem. & Sch.* Var. verrucænum, *Clarke* (in *Kew Herb.*).

A slender rather flexuous-stemmed plant 8–12″ high. Stems tufted 4–5-angular under the sparse irregular umbel. Spikelets all distinct, linear-lanceolate, ·15–·3″ long light-brown, 7–9 only in the umbel. Glumes ·06–·08″ long, ovate acuminate with 3-nerved slightly excurrent keel, glandular-puberulous in the type, glabrate in our plant. Stigmas 3. Nut not compressed, with 2 ridges stronger than the third, broadly obovoid, yellow-brown, verrucose.

Ranchi, 2000 ft., *Clarke*! Fl., Fr. Oct.

L. about half as long as stem, very narrow, flat, glabrous. Umbel subcompound with 2-3 bristle-like bracts up to 1″ long. Rhachilla after fall of glumes with much raised margins to the scars. Glumes somewhat cymbiform. Style longer than nut, glabrous, deciduous with the pyramidal style-base.

This is apparently the same as the published variety *oxylepis*, *Clarke* (*Steud.* sp.).

8. F. monostachya, *Hassk.*

Cæspitose with a dense tuft of fibrous roots and stems thickened at base 3–10″ high compressed and striate, microscopically hispidulous above on one edge. Leaves several at base of stems almost filiform, 1–6″ long, semi-terete, back round, upper surface depressed, base slightly narrowed to the sheath and the edges with a few microscopic hairs. Spikelet solitary (rarely 2–3, *Clarke*) terminal ·3–·4″ long,

ovoid or conical, subtended at the base by 1–3 boat-shaped awned bracts (empty glumes of some) ·14–·25″ long with pale scarious sides, awn sometimes longer than the blade, broad, hispid or muricate. Flowering glumes lower distichous, about 5–6 fruit-bearing ·2″ long, then 5–6 functionally male, the rest male or tabescent, broadly ovate with rounded back, sides converging to a hard tip. St. 3, ·3″ long, with much flattened filaments ·2″ long. Style flattened stout 3-winged below where it forms a narrowly conical base, pubescent up to the 3 stigmas. Nut obovoid or globose above the attenuate base, ·08″ long, 3-sided, angle-ridges extending down the base, straw-coloured, minutely verrucose.

Monghyr Hills, *Kurz*! Nathpur, *Ham.*! Singbhum! Manbhum, *Camp.*! Ganjam, *Fischer* (probably therefore Puri)! Fl., Fr. r.s.

Leaf-sheaths narrow, tip rounded opposite to the blade, covered like the leaves with small red dots. Blade usually recurved, upper surface concave, the epidermal cells very distinct, globose and apparently containing air, lower surface with about 3 delicate nerves each side of mid-rib and rows of numerous minute red dots. Rhachilla after removal of glumes with very prominent red-dotted wings (base of glumes ?). Style (with base) finally deciduous, about ·12″ long, stigmas filiform one-third to nearly as long.

9. F. tetragona, *Br.*

Cæspitose, often robust, with stems 4–24″ high obscurely 4-angular each terminated by a single large conic dense-fld. spikelet ·25–·4″ long. Glumes very many on the larger heads closely imbricate with rounded backs, broadly oblong or ovate at base, ·12–·14″ long or only ·1″ in small heads, with a dark lanceolate 3-nerved centre, paler sides each with about 3 delicate nerves, and hyaline margins, tip rounded. Stigmas 2. Nut linear-oblong, very slightly compressed, but with a slight ridge or nerve along each side, and closely cancellate (cells in about 9 longitudinal series each side of the nut), about ·08″ long, excluding the flattened style-base, straw-coloured. Style persistent.

Wet places, margins of tanks, etc. Near Purneah (in Sikkim Tarai) along stagnant waters, *Kurz*! Ranchi, 2000 ft., *Clarke*! Singbhum, *Clarke*! Hazaribagh, *Clarke*, *Anders.*! Fl., Fr. Sept.–Dec.

Stem nearly leafless, uppermost sheath mucronate or produced into a short blade up to 1″ or 1·5″ long with scarious margin. Spikelet with 2–3 lowest glumes (bracts) empty, longer than the flowering but much shorter than the spikelet, ovate. Rhachilla with minute points after fall of the glumes.

10. F. acuminata, *Vahl.*

Smaller and more slender than *tetragona*, 3–9″ high, like an *Eleocharis* in general appearance with single terminal ovoid-lanceolar spikelets ·2–·35″ long. Median glumes about ·17″ long, oblong-lanceolate scarious, somewhat concave, keeled upwards and keel slightly excurrent. Nut white globosely ovoid, zoned with about 6 transverse flutings, ·06″ long.

Throughout India, *F.B.I.* From Kumaon to the Sikkim Tarai, *Clarke*! and Bengal, *Griff* (without precise locality)! Probably therefore in our Northern Area. Fl., Fr. Oct.

Stem leafless. Uppermost sheath produced on one side 0–·5″.

11. F. schœnoides, *Vahl.*

Cæspitose with stems thickened below, 4–12″ high, striate, slender above and often flexuose when bearing more than one spikelet.

Spikelets 1–3 (on the same plant), distant, ovoid or conical, ·3–·7″ long, dense-flowered with all the glumes spiral, supported at the base or not by a rigid lanceolate bract ·1–1″ long with a rigid green excurrent keel or broad awn. Glumes lower flowering suborbicular concave ·15″ long, keeled above and somewhat mucronate, many-striate. Nut suborbicular-obovate with a short stipes ·07″ long with, ·05″ long without, the stipes, biconvex, very finely minutely brown-striate and microscopically dotted (smooth white rarely discoloured brownish, *Clarke*).

Purneah; *Kurz*! Manbhum (Barakar), *Clarke*! Hazaribagh, 2000 ft., *Clarke*! Orissa, *Walsh*! Throughout India, *Clarke*, and probably throughout our area. Fl., Fr. Aug.–Oct.

Rhizome 0 or very short. Leaves filiform, $\frac{1}{4}$–$\frac{3}{4}$ as long as stem, incurved edges minutely scabrous, superficial cells very distinct. Glumes seriatim deciduous, rhachilla clothed with small scales (bases of glumes?) after their fall or (*fide Clarke*) leaving the rhachilla minutely hairy by the ragged edges of the areoles. Style long flattened, villous.

12. F. sub-bispicata, *Nees & Meyen.*

Cæspitose, rigid, 6–15″ high with leaves shorter than the stem ·04″ broad in middle, obtuse. Spikelets large linear-oblong ·5–·7″ long before fall of glumes, 1–3 rarely 6, usually 1–2 sessile and 1 ray, subtended by 1–2 short bracts. Rhachilla after fall of lower glumes reaching 1″ with very spiral scars. Glumes oblong scarious, median about ·2″ slightly keeled and mucronate above. Nut obovoid or pyriform, smooth, ·06″ long, microscopically striate with dots.

Puri, *Atkinson*! Fl., Fr. May.

13. F. dipsacea, *Benth.*

A little plant growing in dense tufts 2–4″ high and 3–6″ broad with slender or filiform stems and capillary leaves often as long as the stem. Spikelets very numerous, single and in dense umbels with 2–3 filiform bracts often overtopping umbel and up to ·6″ long, subglobose or oblong ·1–·2″ long, echinate with the awns of the glumes. Glumes very narrow, hyaline with green keel excurrent into a squarrose awn as long as the blade, ·06–·08″ long with the awn. Nut ·025–·03″ long linear cylindric glabrous or with capitate hairs mostly curved. Stigmas 2 as long as the style.

Purneah! Santal Parganas, *Kurz*! Sandy bank of Ganges, *Kew Herb.* Fl., Fr. May.

Clarke states that the young pistil is frequently ornamented with clavate glands which usually disappear in fruit, but in one of *Wight's* specimens are developed into ovoid processes nearly as wide as the nut. These glands or capitate hairs are multicellular with the walls of the cells irregularly thickened, the stalks are 1-cellular.

14. F. squarrosa, *Vahl.*

A little tufted plant similar to *F. dipsacea* superficially. Spikelets all oblong ·15–·25″ long in umbels often 2–4″ diam. with bracts usually short, sometimes as long as the umbel. Glumes flat broadly oblong pale fuscous with keel produced into a long squarrose awn equal to or exceeding the blade, ·07–·09″ with the awn. Nut compressed orbicular-obovoid, smooth, pale yellow. Style base swollen with

remarkable pendulous villi all round sometimes ¾ths as long as nut. Stigmas 2.

From the United Provinces to Lower Bengal! Patna, *Wall.*! Dalalganj (Purneah), *J.D.H.*! Santal Parganas, *Kurz*! Fl., Fr. Jan.–May.

Glabrous or pubescent. Stems 2–8″, striate. L. about ½ to ¾ths stem.

15. F. æstivalis, *Vahl.*

A small grass-like tufted and gregarious herb 2–8″ high with very slender erect angular stems and filiform leaves clothed, as well as the sheaths, with small spreading white hairs. Spikelets very small, ·06–·08″ long in compound and decompound umbels with very unequal rays ·2–1·5″ long supported by filiform bracts, the lowest of which usually overtops the umbel and is like the leaves. Glumes ·05–·07″ long few scarious hispidulous cymbiform with green keel excurrent as an erect awnlet (as long as the blade in the lowest glumes only). St. 1. Nut ellipsoid-subglobose or somewhat obovoid 2-convex smooth, slightly margined, very obscurely reticulate, ·02–·03″ long. Style nearly as long as nut prominently bulbous and minutely hairy on the base and with minute unequal scattered hairs upwards, stigmas short recurved puberulous.

Gregarious in wet places. Patna, *Ham.*! Ranchi and Palamau on the pats, elev. 3000 ft.! Fl. May. Annual.

Clarke says of the nut that the outermost cells are quadrate-hexagonal, arranged in 12–16 vertical rows on each face, but far less prominent than in *F. dichotoma*.

16. F. podocarpa, *Nees* (in part).

Cæspitose, about 1 ft. high, with striate or angled somewhat flexuous slender glabrous stems (exc. on some of the leaf-sheaths). Leaves as long as or shorter than the stems, ·07″ wide, ciliate or hispid on margins, sheaths often hairy. Umbels lax with few (sometimes only 3) spikelets, when compound branches with only 1–3 spikelets. Bracts hairy at base and scabrid on the edges above, one often exceeding the umbel, others shorter. Spikelets brown ·15–·3″, mostly supported by a setaceous bract about as long or much shorter with scattered hairs (as on the secondary bracts of the umbel). Glumes concave-ovate or cymbiform, ·1–·12″ long, keeled throughout, very shortly acutely excurrent or minutely cuspidate, lateral nerves 5–7 obscure. Fil. much flattened (arising from base of the foot) ·12″ long. Nut biconvex, nearly orbicular above the large obconic swollen usually toothed foot, ·07–·08″ with the foot, ·05″ without, rounder than in *diphylla*, polished pale yellow or white, strongly margined, about 13-striate with the fine striæ composed of minute raised dots. Style flat, ·06″ long gently tapering, shortly ciliate above the base, stigmas 2 much shorter.

Singbhum! Manbhum, *Clarke*! Fl., Fr. June–Nov.

17. F. diphylla, *Vahl.*

Tufted or stems rather distant on the short rhizome, 1″–2 ft. high striate angled or rarely compressed and sometimes hairy under the umbel which is sometimes reduced to 1 spikelet or simple or compound. Leaves long, sheaths and bracts often densely hairy. Spikelets ·2–·25″ before fall of glumes ovoid-oblong terete not angled above

with the prominent keels of the glumes (as in *dichotoma*), up to ·5″ after fall of lower glumes. Glumes glabrous (*Clarke*) or thinly pubescent towards tip ·08–·1″ ovate, concave, green-keeled and mucronulate, the sides brown or reddish, dry. Nut biconvex straw-coloured, almost glistening or iridiscent white, with a very small foot, ·04–·05″ long obscurely 5-ridged on each face and trabeculate, sometimes longitudinally striate, especially when unripe.

Throughout India (*Clarke*). Ranchi and Palamau, elev. 2000-3000 ft.! Singbhum and Hazaribagh, *Clarke*! Manbhum, *Clarke*! Ganjam, *Fischer*; and probably therefore Orissa. Fl., Fr. May–Oct.

Var. *α.* **annua,** *Clarke* (*Roem. & Sch.*, sp.).

A very minute form 1–3″ high bearing single or up to 3 spikelets. Hazaribagh, *Clarke*! Rajmahal Hills, *Kurz*! Fl. Oct.
(*Clarke* named the Rajmahal specimen first *dichotoma*, then *trispicata*, *Steud.*)

Var. *β.* **pluristriata,** *Clarke*. Syn. F. pilosa of *most authors*, not of *Vahl.*

A slender herb with a nearly horizontal rhizome ·15″ diam. and angled stems about 2 ft. high. Leaves few 6–10″ very slender with inflexed margins, back very villose or long-pubescent, less so on upper surface, sheaths villose. Lowest bract of infl. ·04″ broad, villous like the leaves but usually shorter than inflorescence, erect, other bracts shorter 2–3. Branches of umbel few, very unequal, 0–2·5″ long bearing about 3 spikelets only and secondary bracts, sometimes again branched, sec. and tertiary bracts with acicular pubescent tips. Spikelets brown terete ·15–·2″ long (in fl.). Gl. ·09–·15″ chaffy brown ovate green-keeled in upper half and mucronate, keel 1-nerved shortly sparsely hairy above at least on some glumes. St. 3. Style very flat with close spreading pubescence especially below the stigmas, ·08″ long, stigmas nearly as long slender but easily breaking. Nut ·05″ pyriform with a very small foot, white, marked with about 13 longitudinal rows of minute white dots.
Ranchi! Palamau! Elev. 2500 ft. Fl. Fr. May.
In the multi-striate nut this comes close to *podocarpa* of which I should rather consider it a variety than of *diphylla*.

18. **F. dichotoma,** *Vahl.*

A very small tufted sedge rarely attaining 10″ in height, often only 2–3″ with flattened striate stems terminated by compound or decompound umbels of narrowly ovoid spikelets ·1–·15″ long elongating after fall of lower glumes to ·3″. Glumes closely spirally imbricate ·05–·06″ long, boat-shaped with strong keel excurrent into a mucro. Nut ·025″, biconvex straw-coloured, 5–9-striately ridged on each face and closely beautifully cancellate, base not produced. Style flat villose above, twice length of nut, stigmas somewhat tapering over half as long as style. On fall of style-base the nut has a minute apiculus.

Chiefly in rice-fields, common. Chota Nagpur, *Wood* (without precise locality)! Manbhum, *Camp.*! Hazaribagh, *T. Anders.*! Midnapur (near Singbhum), *Abdul Huk*! Banks of Ganges (probably Sant. Parg.), *Kurz*! Barkuda (Chilka Lake), "on the sandy foreshore," *N. & C.* Fl., Fr. c.s. and *Kurz's* specimen in his.
L. often as long as stem usually shorter ·03–·07″ wide, superficial cells very distinct (as in most of preceding). Umbels 1–4″ diam. with 1–2 bracts nearly as long. Glumes with the prominent keels green 1–3-nerved. In some specimens the top of stem and lowest glumes are minutely pubescent.

19. **F. ferruginea,** *Vahl.* Syn. F. trispicata, *Steud.*

Stems 8–30″ cæspitose rather stout. Leaves very short or hardly any, sometimes 4–6″ with the taller stems, glabrous or hairy. Umbel

usually of few (5–10) spikelets, sometimes reduced to 1 or 3, sometimes compound with 20 spikelets. Bracts shorter than umbel. Spikelets ovoid ·2–·4″. Glumes ·12″ ovate or broadly ovate and somewhat keeled upwards, nearly flat, apiculate, brown, with hoary upper half, due to a minute pubescence. Nut white or pale yellow ·06″ orbicular-obovoid, minutely stipitate and apiculate, not at all ridged as in *diphylla* but very closely microscopically multi-striate with dots. Style longer than nut flat, hairy below the stigmas.

Throughout India, *Clarke*. Bengal, *Masters* (without locality)! Common about Calcutta, *Cal. Herb.*! Probably therefore in Orissa. Fl., Fr. May–Oct.

20. **F. spathacea,** *Roth.*

A tufted very rigid plant 4–12″ high with stems swollen below and very numerous short leaves ·7–5″ long by ·06″ wide. Spikelets often congested (but distinct, not usually clustered) ·1–·15″ long before fall of glumes, in compound umbels ·5–1″ long. Glumes ·06″ brown with white or hyaline rounded tips and upper margins, keeled, muticous often notched. Nut dull black obovoid with minute stylar scar but not apiculate, smooth or somewhat tubercled.

Puri, *Atkinson*! Chilka Lake, *Hooper*! Fl., Fr. May–Aug.
L. with incurved margins, obtuse, only ·7–1·5″ in the Puri plant. Umbel (*fide Clarke*) 2″ diam. in well-developed examples, in less developed examples the spkts. are nearly or quite clustered, sometimes virtually in a single head. Bracts short ·4″ rigid, with rather scabrid keel, partial bracts shorter, cuspidate. Stamens usually 2. Style somewhat shorter than nut, often glabrous.

21. **F. argentea,** *Vahl.*

A small cæspitose species with the habit of *squarrosa*, with many filiform leaves usually shorter than the stem, glabrous except for a few small points along the margin, surface cells prominent, back striate. Spikelets pale brown clustered in single heads, ·2″ long before fall of the lower glumes then elongating to ·4″, rhachilla after fall clothed with small cups from the height of the margins of the scars which are apparently the bases of the fallen glumes. Glumes lanceolate to ovate ·05–·06″ acute, with prominent 3-nerved keel. Nut pale ·02″ obovoid smooth or with faint transverse wavy lines slightly margined, stylar scar rather large.

Western Bengal and Bihar, *Kurz*! This is the only record but there are specimens from Central India, the Peninsula and Lower Bengal so that it is probably distributed through our area. *Kurz* says "in dried up rice-fields, frequent." Fl., Fr. Dec.–Jan.

22. **F. Hookeriana,** *Boeck.*

A tufted annual 4–10″ high with compressed stems and narrow flat leaves often as long as the stem. Of very different appearance from any of the preceding from the narrowly linear acute spikelets ·4–·6″ long clustered and solitary on the erecto-patent branches of umbels often 4–6″ diam. Spikelets 4–6 in a cluster, ·1″ or less broad. Median glumes about ·15″ long, narrowly lanceolate very acute, rusty green, keeled, brown scarious on the sides. Stigmas 2. Nut ·03″ long obovoid biconvex obtuse or truncate, very shortly stipitate, light brown, slenderly longitudinally 12–15-striate on each face from the

regularly superimposed transversely oblong outer cells, and shoulders of nut subtuberculate by small scales or papillæ.

Ranchi, 2000 ft. *Clarke*! Fl., Fr. Nov.

23. **F. sericea,** *Br.*

A very distinct species in its thick elongated rhizomes ·3″ diam. with the closely imbricating brown leaf-bases and beautifully silvery-silky closely imbricating leaves ·5–2″ long, ·1–·14″ wide. Sheaths at base of stem silky. Stems 3–6″. Spikelets ·2–·3″ long capitate 2–6 in a cluster and clusters mostly umbelled with short silky-hairy acuminate bracts. Glumes ·08–·14″ long, keeled, mucronate silky. Nut obovoid smooth pale biconvex.

Puri, *Atkinson*! Margins of freshwater lakes. Fl., Fr. Jan.–May.

9. BULBOSTYLIS, *Kunth.*

Annuals with fibrous roots and slender stems leafy only near the base. Leaves very narrow and sheaths generally finely hairy. Spikelets congested or umbelled, rarely umbel reduced to one spkt. Glumes imbricate on all sides 2–1 lowest empty, many succeeding 2-sexual, uppermost tabescent. Bristles 0. Stamens 3–1, usually 2. Style as long as nut, linear, glabrous, with very small bulbiform base and leaving a minute button on the nut after falling; stigmas 3. Nut obovoid obtuse 3-gonous, smooth, scarcely stipitate.

The button on the nut is ultimately deciduous and is sometimes so small as to be scarcely distinguishable from the apiculus in some *Fimbristylis*. The usually finely hairy sheaths and 3 stigmas then usually serve to distinguish the genus from *Fimbristylis*.

I. Spikelets in dense terminal (or pseudo-lateral) clusters:—
Very slender. Leaf-sheaths only hairy. Hds. not harsh . 1. *barbata.*
Rigid with curled leaves, mostly pubescent all over. Hds. almost prickly . . . . . 2. *subspinescens.*
II. Spikelets discrete, umbelled or rarely umbels reduced to a single spikelet. Leaf-sheaths hairy . . . . . 3. *capillaris.*

1. **B. barbata,** *Kunth.* Syn. Scirpus barbatus, *Rottb.*

A tufted small grass-like herb 1–10″ high with very slender striate stems and capillary leaves as long as or shorter than the stems, sheaths very slenderly pilose especially in the throat. Spikelets linear, angled, ·07–·27″ long in dense clusters at the top of the stem, sometimes appearing lateral from the longest bract being erect and about twice as long as the head. Glumes ·07″ long, cymbiform, keel of lower glumes excurrent as a very short awnlet, sides rusty-brown or dotted, keel and margins sometimes very minutely hirtellous. Nut obpyramidal or obovoid, ·025″ long, pale brown or yellow with the small bulbiform apiculus not larger than the foot, most minutely transversely striate or punctulate.

Common. Purneah, *Cal. Herb.*! Monghyr Hills, *Kurz*! Sant. Parg., *Gamble*! Ranchi (on Ichadagh, 3000 ft.)! Manbhum, *Camp.*! Singbhum! Puri, *Walsh*! Barkuda (Chilka Lake), *N. & C.* Fl., Fr. July–Dec.

Scarcely distinguishable from some *Fimbristylis*, which have the button on the nut nearly as large. Leaves usually 2–4″ only. *Clarke* says "glumes scarcely acute," but all our specimens show some at least of the glumes with excurrent keel. Gl. triangular-ovate when unfolded. Rhachilla zigzag or spiral, narrowly winged between the angles. St. 3-1.

2. B. subspinescens, *Clarke.*

Cæspitose, closely pubescent all over or stems glabrate, 1–4″ high often curved. Leaves about ⅓ to ½ length of stem, numerous, curved acicular, striate, pubescent with very broad striate sheath. Spikelets ·15–·25″ long in a dense almost prickly terminal head about ·3″ diam., pointed bracts about as long. Glumes ·12–·14″ long with brown (when dry) somewhat rounded keel scarcely excurrent and scarious sides, finely pubescent. St. 1 (–3 ?). Style slender about ·05″, stigmas nearly as long. Nut pale brown (*Clarke;* I have only seen unripe ones).

Sands on the Puri coast, *Clarke, Atkinson, Walsh,* etc. !

3. B. capillaris, *Kunth.*

A very slender tufted sedge 3–10″ high with capillary leaves ½ to ¾ as long as the striate stems. Sheaths with very slender hairs, at least in their throats. Spikelets ·1–·25″ long, solitary or umbelled or umbels compound, rays rarely more than ·7″ long, bracts almost glumaceous awned or with filiform tips, rarely ·2″ long. Glumes ·07″ long broadly ovate cymbiform with acute keel scarcely or not excurrent or lower sometimes with a minute awnlet; keel 3-nerved, sides nerveless. Nutlet ·025″ long and nearly as broad, obovoid triquetrous slate-coloured when ripe, very closely minutely dotted (pale transversely undulate, *Clarke*. Probably unripe. The dots are sometimes in somewhat undulating transverse lines), surface shining between the dots.

Western Bengal and Behar, *Kurz* ! Parasnath, *Cal. Herb.* ! Fl., Fr. Sept.

10. SCIRPUS, *L.* (in part).

Small or large sedges, all glabrous, or inflorescence slightly hairy. Spikelets 1–many in a simple or compound inflorescence, usually many-flowered with all the glumes spirally imbricated, rarely lower subdistichous, 1–2 lowest glumes empty, uppermost tabescent. Bristles present or absent (sometimes broad in *littoralis* and *isolepis*). Stamens 1–3, anterior. Anthers linear or linear-oblong. Style with a linear or conic base continuous with the nut, not enlarged over a bulbous swelling (as in *Eleocharis*, *Fimbristylis* and *Bulbostylis*). Stigmas 2 or 3. Nut plano-convex, biconvex or trigonous, sessile or nearly so, sometimes apiculate.

I. Spkts. 1-many, sessile in simple clusters (1–2 rays sometimes added in *supinus*):—
  A. Small herbs with small spkts. under ·25″. Gl. ·02–·1″ long. Bristles 0:—
    1. Style very short:—
      Spkt. 1 only ·07–·15″ long. Gl. not awned. Stig. 2 . 1. *isolepis.*
      Spkts. 1–few, ·1–·2″ Gl. long-awned. Stigmas 3 . 2. *squarrosus.*
    2. Style long. Spkts. several. Gl. mucronate. Stig. 3 . 3. *supinus.*
  B. Spkts. over ·25″. Glumes over ·1″ long:—
    1. Bristles 0. Stem terete. Heads near base:—
      Stems septate when dry. Spkts. ·3–·5″ . . . 4. *articulatus.*
    2. Bristles 3–6. Stems 3-quetrous:—
      Heads lateral. L. very small or 0. Spkts. ·25–·5″ . 5. *mucronatus.*
      Hds. terminal. L. long. Spkts. ·3–·8″ . . . 6. *maritimus,* var.
II. Spikelets many stalked or umbelled. Robust sedges. Bristles usually present:—

A. Umbels often sub-capitate or simple, never decompound:—
Gl. ·25″. Bristles 6–3 scabrid . . . . . 6. *maritimus.*
Gl. ·15″. Bristles plumose or long-pubescent . . 7. *littoralis.*
B. Very robust, with decompound umbels 5-8″ broad. Gl. ·12–·14″. Bristles smooth or scabrid . . . . 8. *grossus.*

1. **S. isolepis,** *Boeck.* Syn. Hemicarpha isolepis, *Nees.*

A very small tufted annual with setaceous stems ·5–4″ high only, bearing a single spikelet ·07–·15″ long below the top, almost at right angles to the stem (and short erect bract). Leaves 1–2, ·25–1″ long, filiform. Glumes minute ·02–·03″ obovate rhomboid obtuse, minutely mucronulate with the excurrent keel. Bristles 0 but a thin hyaline obovate irregular scale (rarely 2), as long as the nut, is sometimes obliquely laterally placed between the nut and glume (*Clarke* in *F. B. I.*). St. 1, lateral. Nut a little shorter than the glume, biconvex, narrowly obovoid, beautifully white reticulate with the areoles black. Style less than ¼ nut, stigmas short recurved. Bristles 0.

Ranchi, *Clarke*! Plains of Bihar, *J.D.H.*! Monghyr! Fl., Fr. Nov.

2. **S. squarrosus,** *L.*

A small sedge 1·5–10″ high. Leaves 1–2 short, on the inflated many-nerved sheaths. Spikelets densely softly bristly from the tails of the glumes, usually 1–4 (up to 10, *Clarke*), clustered almost at right angles on the stem, ·1–·2″ long or elongating to ·4″ after fall of lower glumes. Bract ·3–2″ long, erect (when the spikelets appear lateral) or not, a second shorter bract often present. Glumes oblong square shouldered then suddenly contracted to an awn or tail longer than the blade, ·03″ long without the tail which is slightly recurved. Bristles 0. St. 2–1, very short. Style minute with 3 recurved stigmas. Nut ·02″, narrowly obovoid, trigonous, brown to black, very minutely black punctulate much as in the last.

Monghyr, *Ham.*! Singbhum sands of the Karo River! Hazaribagh, *Clarke*! Manbhum (Barakar), *Clarke*! Fl., Fr. Sept.–Jan.

3. **S. supinus,** *L.*

A leafless or nearly leafless sedge 2–18″ high (usually 4–8″) with slender terete stems sheathed at the base and terete brownish spikelets ·12–·2″ long in lateral clusters, occasionally with a stalked cluster (ray) added. Glumes ·08–·1″ long, cymbiform, keel narrow ending in a minute usually black or dark coloured acute mucro, lateral nerves 0. Bristles 0. Nut ·04–·045″ long, more or less 3-sided but one face usually broader than the other two and the angle between the two smaller faces sometimes rounded, faces transversely undulate-lineolate, apex minutely apiculate.

Rice-fields and rivulets. Ranchi, *Gamble*! Singbhum, common! Hazaribagh, common! Probably in all districts.

Short leaves, usually under 1″ are sometimes present. Head of spikelets sometimes placed about the middle of the stem (some botanists treat the stem above the head as the lowest *bract*) but usually higher. Spkts. usually 15–20-fld. Gl. with linear green keel and brown-scarious sides. St. 3. Stigmas 3.

Var. **uninodis,** *Clarke.* The heads are sub-umbellate, *i. e.* having 1–3 rays rarely 1″ long in addition to the sessile head.

Hazaribagh, *Clarke.*

4. **S. articulatus,** *L.*

A cæspitose sedge with terete fistular (appearing quite flat when dried for the herbarium) stems 1–2 ft. high, septate when dry and then ·2–·4″ diam., spongy, leafless (barren stems may sometimes be taken for leaves). Spikelets brown ·2–·5″ long in a single dense lateral head usually within one to a few inches of the base. Glumes ·15–·2″ long membranous not keeled or only slightly keeled, ovate, acute entire. Nut obovoid 3-quetrous, ·07″ long, with transverse wavy striæ, top pyramidal.

Marshy ground, sides of tanks. Singbhum! Manbhum, *Clarke*! Also probably Sambalpur (I have collected it in Raipur). Fl., Fr. Dec.–Jan.

Root fibrous. Sheaths short rather loose with very oblique tip but no blade, margins of tip scarious. St. usually 3. Style with the stigmas ·1″ long. The stem above the spikelets may be a bract as in many other species.

5. **S. mucronatus,** *L.*

General habit of *S. articulatus* but the stems 3-quetrous or 3-winged and spikelets ·25–·5″ long in a cluster near the top, the stem (or bract) beyond the inflorescence ·5–3″ long. Bristles 5–6 unequal, retrorsely hispid. Nut obovoid unequally trigonous shining black scarcely transversely wavy.

Monghyr, *Ham.*! Ranchi, elev. 2000 ft. *Clarke*! Singbhum 2000 ft., *Clarke*! Fl., Fr. Oct.–Nov.

Usually with a short rhizome. Glumes ·1–·2″ broadly ovate, keeled and many-nerved slightly mucronate, margins sometimes minutely scabrous. Nut with two smaller faces sometimes giving place to a single curved face, minutely apiculate, ·05–·06″ long.

6. **S. maritimus,** *L.* var. affinis, *Roth* (sp.).

A robust or slender sedge 1·5–6 ft. high with 3-quetrous leafy stems. Leaves grass-like often as long as stems ·15–·2″ wide (in small specimens, doubtless much wider in taller plants). Spikelets large, ·3–·8″ long, ovoid, in a dense terminal (the basal bract not appearing like a continuation of the stem) cluster of 2–5 supported by a foliaceous bract often 4–10″ long. Glumes ·25″ long, nearly flat with strong excurrent midrib produced into an awn, puberulous, margins membranous, sometimes sub-fimbriate. Bristles 4, as long as nut. Nut ·09″ long, compressed, sub-convex, smooth most minutely uniformly dotted, finally black. Stigmas 2.

Banks of the Ganges, *Kurz*. Fl., Fr. Feb.–April

The type which occurs in the United Provinces and extends to E. Bengal may also occur, it has a simple or compound umbel, 6–3 bristles and 3-fid style. *Clarke* says there are intermediate forms.

Rhizome creeping woody with nodes dilated into tubers.

7. **S. littoralis,** *Schrad.*

A tall rather stout sedge 2–5 ft. high with stems mostly 3-gonous upwards, terete below. Leaves short or 0. Spikelets large, sometimes almost clustered but usually distinct from one another on short pedicels, sometimes inflor. compound with unequal compressed suberect rays 1–2″ long, lateral, about 1″ below the 3-quetrous top of the stem (or bract), with several scarious bracts at the base. Glumes somewhat concave, ·15″ long, elliptic-oblong, red brown with scarious

margins, rounded notched or subentire but midrib excurrent as a short cusp or awn, lateral nerves obscure. Bristles 4–5, ·05″ long, pubescent or plumose upwards. St. 3–2 longer than the bristles; anther shortly appendaged (red-crested, *Clarke*). Nut obovoid, compressed, apiculate, brown, ·06–·07″ smooth (faintly marked with the minute longitudinally elongated cells under high power).

In shallow waters of the Chilka Lake! Fl., Fr. Dec.–Jan.

Rhizome hardly any, sometimes slender stolons are present (*Clarke*). L. 1–2″ or sometimes 4″ long and green (*Clarke*). The young spikelets are often deep purple, the old ones light brown, when full grown they are 3–6″ long, or more after fall of the lower glumes. Pedicels flattened, scabrous. Edge of glumes often sparsely puberulous. Style about ·1″ and stigmas longer.

8. **S. grossus,** *L. f.* Syn. S. kysoor, *Roxb.*: S. maximus, *Roxb.* ? Kesor, Kesari, *Beng., H.*

A very large sedge 4–6 ft. with the roots or stolons frequently bearing black tubers. Stems sharply 3-quetrous or 3-winged. Leaves almost as long as the stem, spongy, up to 1″ broad. Involucral bracts 3 foliaceous up to 18″ long. Spikelets brown ovoid ·15–·3″ long in large decompound panicles 5–8″ long and broad. Glumes brown scarious ·12–·14″ long nearly muticous or with a short cusp or awn up to ·05″ long (var. *kysoor*) proceeding from the back below the apex, broadly obovate-oblong, concave, midrib below cusp distinct or obscure otherwise nerveless. Bristles usually 6, sometimes fewer, exceeding the nut. Nut ·07″ long including the marked apiculus, elliptic-obovoid, 3-gonous, brown, without markings.

In tanks, etc., usually in a foot or more of water. Northern Bengal, *Kurz*! Ranchi! also at Raipur in the C.P. and Bengal and probably in Sambalpur and other districts. Fl., Fr. Sept.–Dec.

Wings of stem, edges of leaves and involucral bracts sometimes minutely scabrous (soft and smooth in my C.P. specimen). L. keeled, sowewhat translucent when fresh. Branches of panicle angled, scabrid. Rays, pedicels and glumes sometimes minutely pubescent. Anthers 3, ·1″ long linear, minutely apiculate. Bristles, I believe, always occur in our plant but they are rather late in development and are small in the flower (possibly *Roxburgh's S. maximus* is a distinct species ?), barbs on the bristles not always found. Ovary linear with a very large style base. Style ·03–·04″, stigmas 3, longer than the style.

Used for making coarse matting in Dinajpur (Bengal). The small tubers are eaten.

11. ERIOPHORUM, *L.* Cotton-grass.

Glabrous or nearly so with leaves only near the base. Spikelets few or many with all glumes spirally imbricate. Bristles 6 divided nearly to the base into numerous capillary segments which become greatly elongated in fruit so that the inflorescence becomes cottony. Stamens 3–1, anterior. Style slender, glabrous, deciduous, stigmas 3. Nut sessile, 3-gonous, smooth, narrowed at the apex.

1. **E. comosum,** *Wall.*

A tufted wiry sedge with swollen bases to the stems, somewhat resembling "Bhabar grass" in general appearance (with which it has sometimes been confused) the leaves being long and very narrow and often overtopping the stem, edges scabrid, leaf-sheaths not woolly as in the "Bhabar grass," but upper parts like the stems sometimes very thinly pilose. Flowering stems 4–30″ slender, tough, bearing com-

pound or decompound irregular umbels of brown narrowly ellipsoid spikelets ·2–·3″ long which are soon overtopped by the cotton-like tufts of the hypogynous "bristles." Nut linear, 3-gonous, beaked, smooth, ·1″ (*Clarke* says brown-black, mine are pale).

It extends from Kumaon to Chittagong, but chiefly in low hilly tracts, and *Griffith's* specimen from Bengal is from cliffs. It probably occurs (and I think I have seen it there but can find no specimen) in the Ramnagar Hills of Champaran. Fl., Fr. Sept.–Nov.

12. FUIRENA, *Rottb.*

Mostly hairy sedges leafy to above the middle or to the top. Leaves grass-like. Spikelets clustered, many-flowered, uppermost glumes tabescent. Glumes spirally imbricate all round, strongly aristate, hairy in upper half. Hypogynous bristles 6, 2-seriate (referred to as sepals and petals respectively) or reduced or 0, sepals bristle-like, petals often with slender claw and broadly expanded top. Stamens 3 or 2. Style long, glabrous, deciduous (above the base), stigmas 3 long. Nut small, 3-quetrous, more or less pedicelled, usually narrowed at top.

Annual. Petals large quadrate with slender claw . . . . . 1. *glomerata.*
Perennial. Petals oblong-obovate sessile . . . . . 2. *umbellata.*

1. F. glomerata, *Lam.*

An erect tufted sedge usually about 1 ft. high leafy to the top with the stems or leaf-sheaths patently hairy. Leaves 2–5″ usually densely hairy. Spikelets greenish subcapitate, heads 1–3 (rarely up to 10) axillary and terminal. Glumes about ·06″ long (without the awn) orbicular obovate hairy with a green hairy dorsal awn nearly as long as the blade. Petals large quadrate with slender claw, ·05″ long, persistent. Nut rather shorter than the petals, brown, equally 3-quetrous, elliptic obovoid with a small linear apiculus (style-base).

In rice-fields, common. Bihar, *J.D.H.*! Ranchi, *Gamble*! Singbhum! Manbhum, *Ball*! Giridih (Hazaribagh), *Prain*! Sambalpur! Probably in all districts. Fl., Fr. Oct.–Jan. Annual.

Leaves often 2″ broad, linear, acute or tapering from base to apex, sheaths rather inflated. Bracts exactly like the leaves, not much overtopping the clusters. Spikelets ·25–·3″ before the fall of the glumes, ultimately often ·45″ with rather stout rhachilla marked with regular areoles with acute edges. Glumes with 3 distinct nerves converging to the awn. Petals often apiculate, blade longer than claw.

2. F. umbellata, *Rottb.*

Very similar to *F. glomerata* in general appearance, but it has a long creeping rhizome, usually more compound umbels and is particularly distinguished by the shape of the "bristles" or petals which are oblong-obovate sub-sessile, 3-nerved, truncate or very obtuse at the top and sometimes with a fine apiculus or mucro.

There are no specimens from our area, but as it occurs in the Sikkim Tarai, Central Provinces, Madras and Eastern Bengal, it most probably occurs. *Clarke* says "throughout India except the drier North-west." Fl., Fr. Sept.–Dec.

13. LIPOCARPHA, *Br.*

Glabrous sedges leafy only near the base, bearing a single head of few (usually 1–6) spikelets with very many 2-sexual flowers. Glumes

imbricate on all sides. Perianth or bristles represented by 2 hyaline elliptic median scales (apparently connate bristles). Stamens 3–1, anterior, with small linear-oblong muticous anthers. Style small, glabrous, stigmas 2 or 3, scarcely exsert. Nut small oblong ovoid or obovoid, plano-convex or 3-gonous, smooth, minutely punctulate, closely invested by the hyaline scales.

Scales much longer than the nut. Style ½–¾ nut . . . . 1. *argentea.*
Scales about as long as the nut. Style under ½ nut . . . . 2. *sphacelata.*

1. L. argentea, *Br.*

Rhizome hardly any. Stems usually 10–20″ obscurely 3-gonous. Heads of 1–8 pale shining, or sometimes fuscous, broadly ovoid spikelets ·15–·25″ long supported by a usually spreading or reflexed bract 1·5–3″ long and a shorter one. Glumes ·1″ long, ·05″ broad above, spathulate-oblanceolate with triangular tip, nearly flat, keel sometimes slightly excurrent, sides hyaline with about 2 delicate nerves and brown marks. Scales narrowly lanceolate ·08″ long entirely enclosing the nut, separable into longitudinal shreds. Nut ·04–·05″ long, brown, narrowly oblong obovate-oblong, plano-convex or 2-convex, very minutely closely dotted.

Frequent along stagnant waters in the Sikkim Tarai, *Kurz*! Hazaribagh, *Clarke*! Barkuda (Chilka Lake), at the side of a footpath, *N. & C.* Fl., Fr. Oct.
The leaves are usually shorter than the stem, about ·08–·1″ broad, apparently somewhat concave, many-striate.

2. L. sphacelata, *Kunth.*

Habit and height of *L. argentea*. Spikelets 1–8, dark purple or purple-spotted, rarely pale, ovoid, ·15–·2″ (before fall of the glumes) attaining ·4″. Glumes ·07″ long, ·04″ wide at the top, cuneate-obovate (shape much as in last) with broadly triangular suddenly acute tip, about 2-nerved each side of slender midrib. Scales ·06″, oblong, acute, hyaline, 6-nerved (or striate, perhaps the boundaries of the individual bristles). Nut brown, ·05–·06″, *i. e.* nearly as long as the scales. Style very short (only about reaching the top of scale).

Western Bengal and Behar, *Kurz*! Hazaribagh, *Anders.*, etc. Manbhum, *Clarke*! Fl., Fr. Oct.–Dec.
After fall of the lower glumes the stout rhachilla (as in the last) is closely covered with trapezoidal areoles with a depressed button-shaped scar inside each.

14. RHYNCHOSPORA, *Vahl.*

Habit rather various. Leaves long, narrow. Spikelets often clustered in heads or panicles. Glumes usually 7–8, lower more or less distichous, 3 lowest or sometimes more empty, next one or sometimes 2 usually longer containing a perfect nut-bearing flower, uppermost male or sterile thinner in texture and rounder on the back than the perfect. Bristles present or not. Stamens 3–1, anterior. Style long linear glabrous, stigmas 2, style base dilated. Nut oblong or ovoid, compressed, beaked by the persistent style-base.

I. Spikelets in a single terminal head . . . . . 1. *Wallichiana.*
II. Spikelets panicled:—
Spikelets discrete in panicled corymbs, ·2–·3″ long . . . 2. *aurea.*
Spikelets ·15–·2″ long mostly in clusters, clusters loosely corymbed . . . . . 3. *Hookeri.*

1. **R. Wallichiana,** *Kunth.*

Tufted with stems 4–24″ trigonous, striate. Leaves several, about half as long as stem, minutely scabrous, sometimes hairy. Spikelets 20–50 in the head which is ·5–·7″ diam. with 3–8 bracts 1–3″ long. Glumes 6–7, 3–4 lowest empty, ovate, next one longer with a perfect flower. Bristles 6–4 or rudimentary or 0. Nut obovoid minutely scabrous on shoulders, with narrow conic beak one-fourth to one-third the length of nut. Stigmas short.

Throughout India, common, *Clarke.* Sikkim Tarai, *Clarke*! and also Central Provinces! but no specimens actually from within our area. Fl., Fr. Oct.

2. **R. aurea,** *Vahl.*

A stout herb 2–3 ft. high, smooth or scabrous upwards with leaves 1–2 ft. long by ·5–1″ broad, the whole length of stem. Spikelets numerous brown lanceolar acuminate ·2–·3″ long in several (3–5) corymbs on a panicle often 1 foot long. Glumes about 7, lowest 3–4 ovate smaller, next one with perfect flower. Bristles 6, as long as nut, sometimes unequal or deficient. Nut obovoid truncate with beak as long. Stigmas 2 short.

North Bengal, *Kurz* (possibly Purneah)! Common throughout India, *Clarke.*

3. **R. Hookeri,** *Boeck.*

Less robust than *aurea* and with a very lax inflorescence of distant clusters of ovoid acuminate spikelets ·15–·2″ long, clusters with 1–5 spikelets. Nut obovoid chestnut-coloured, smooth, suddenly narrowed into a very small cylindric neck, beak linear as long as the nut greenish straw coloured (in *R. aurea* the beak is nearly as broad as the nut at base).

Nathpur, *Ham.*! (There are two Nathpurs, one in Bhagalpur, the other in Dinajpur to the east of Purneah, the one within, the other close to our area.) Fl., Fr. Aug.–Sept.

15. SCLERIA, *Berg.*

Annual or with rhizomes. Stems leafy 3-sided. Leaves grass-like, 3-nerved often with cutting scabrid edges, base sheathing. Spikelets in an elongate compound panicle with the partial panicles in the axils of leaves which become bractiform upwards, panicle sometimes narrow or reduced nearly to a spike. Flowers all unisexual, male and female in the same spikelet or more usually in distinct spikelets in the same cluster or branch. Bisexual spikelet with one female flower below and a few males above, female spikelet similar but upper male portion reduced to a small rudiment or 0 (when the female fl. appears terminal). Glumes several, 2–4 empty in the female spkt. below the fruit-bearing "female glume"; fem. glume amplexicaul but margins not united round the pistil, male spikelets with 2–3 empty glumes at base and often several anther-bearing, stamens 3–1, anthers linear often mucronate. Nut bony and usually shining, style linear, deciduous, stigmas 3 long. There is usually a short gynophore under the nut dilated into a saucer or disc which is often 3-lobed.

The *Selerias* are usually easily recognisable from the inflorescence and large ellipsoid or sub-globose white nuts, but the inflorescence of the *cruciata-plebeja* group of *Carex* is very similar to the *elata* group of *Scleria*.

The following series advance in general from the more slender with simple spicate inflorescences to the more robust with compound inflorescences and pyramidal partial panicles.

I. Bi-sexual spikelets many, with sometimes a male spkt. close beneath :—
  A. Inflorescence a simple spike with spkts. in distant clusters. Nut verrucose. Annual . . . . 1. *pergracilis*.
  B. Inflor. with a few simple branches. Perennial :—
    Nut smooth . . . . . 2. *lithosperma*.
    Nut transversely wrinkled . . . . . var. *Roxburghii*.

II. Bi-sexual spikelets 0 or few :—
  A. Annuals with fibrous roots :—
    Panicle branches mostly simple. Disc 3-lobed. Nut with close much raised reticulations . . . . 3. *tessellata*.
    Partial panicles dense, compound. Disc truncate. Nut quite smooth . . . . . 4. *annularis*.
  B. Perennials with horizontal nodose rhizomes and pyramidal partial inflorescences. Leaves mostly caudate-setaceous :—
    Stems 2–3 ft. Disc-lobes lanceolate thin brown . . 5. *hebecarpa*.
    Stems up to 4–5 ft. by ·3″. Disc-lobes short obtuse . 6. *elata*.

1. S. pergracilis, *Kunth*.

A very slender sedge 10–20″ high with the inflorescence unbranched, consisting of clusters of spikelets in an interrupted very narrow spike 2–6″ long, clusters ·3–·7″ apart, their bracts ·2″ or less long. Bisexual spikelets many, terminal, ·16″ long, with sometimes a male spkt. beneath. Fem. glume cymbiform, ovate-lanceolate, ·08″ long, mucronate. Nut white, subglobose-ovoid above the short 3-quetrous gynophore, verrucose, obtusely 3-gonous, ·04″ diam.

Western Bengal and Behar, *Kurz*! Hazaribagh, *Kurz*! Hazaribagh, *Anders*. (but *Clarke* says doubtfully collected there) !

Lower sheaths often a little pubescent. L. 4–10″ long up to ·12″ wide. Clusters usually of 2–5 spkts. M. glumes above the female brownish, not keeled.

Trimen says that the leaves are lemon-scented and used to drive away mosquitoes.

2. S. lithosperma, *Sw*.

Usually slender 1·5–3 ft. high, the inflorescence with few slender distant simple branches or in robust specimens sometimes again branched but sec. branches weak. Spikelets in small clusters on the branches and near the end of the main axis, many 2-sexual, lower bracts often long and setaceous. Fem. glume ·15″ long, ovate cymbiform, cuspidate. Nut ·1″ long, ·08″ diam. very broadly ellipsoid, trigonous with trigonous gynophore, perfectly smooth and white in the type. In var. *Roxburghii*, *Thwaites*, the nut is rather larger with pyramidal subacute apex, transversely wrinkled and with minute ferruginous glands.

Santal Parg., *Wall* ! Chota Nagpur. Hazaribagh, *Clarke*! Singbhum, *Clarke*! Western Bengal and Behar, *Kurz*, the variety on Parasnath ! Fl., Fr. Oct.

Rhizome elongate, horizontal, woody. Stems not tufted. Leaf-sheaths usually hairy. L. 6–12″ long, up to ·2″ wide. Panicle reaching 1 ft. in large specimens, thin and straggling.

In var. **Roxburghii**, *Thwaites*, the partial panicles are said to be much more rigid and subpyramidal and the clusters of spikelets more numerous and dense. The Parasnath specimen, however, is very thin with secondary panicles simple spicate.

3. **S. tessellata,** *Willd.*

Stems 1–2 ft. high, rather slender, hairy or glabrate. L. linear acuminate but not setaceous at tip 4–10″ long by ·1–·2″, margins scabrid. Panicle narrow, glabrous, main branches remote in the axils of leaves or leaf-like bracts only 1–2″ long on peduncles 0–4″ long. Spikelets clustered in the axils of rigidly acuminate keeled bracts averaging about ·5″ long with margins and keel scabrid. Bisexual spkts. few or 0. Fem. spkts. ferruginous green ·18″ long, glabrous, in same clusters as male spkts. Nut broadly ellipsoid-ovoid, ·1″ long, ·09″ diam., white, with close much raised reticulations especially when unripe, at last often nearly smooth, seated on a 3-lobed disc with lobes triangular or lanceolate.

Western Bengal and Behar, *Kurz*!

Rhizome hardly any, roots fibrous. L. with white hairs or glabrate (*Clarke*, all glabrous in our specimens), sheaths conspicuously winged or not. Fem. glume broadly ovate-cymbiform cuspidate. Anthers with a large apiculus.

4. **S. annularis,** *Kunth.*

Externally very like *S. tessellata*, Willd., with triquetrous stems 1–2 ft. high and 3-winged sheaths scabrid on the angles with reflexed papillæ, and hairy on the margins near the mouth. Spikelets in the partial inflorescences more dense than in *tessellata* but with similar rigid bracts with scabrid keels. Spikelets similar but the female disc with truncate margin instead of lanceolate lobes and the nut perfectly smooth white, broadly oblong or somewhat obovoid.

This which has been found by me in the rocky hills of Bilaspur so like those of the not distant Sambalpur and Palamau, and has also been found by *Griffith* in Bengal, is almost certain to occur in Chota Nagpur or Sambalpur. Fl., Fr. Oct.

Roots fibrous, dark red, *Clarke*.

5. **S. hebecarpa,** *Nees.*

Stems 2–3 ft. high from a woody horizontal rhizome, 3-quetrous. Sheaths, or some of them, usually distinctly 3-winged, slightly hairy or villous. Leaves 1 ft. long, up to ·35″ broad, long-acuminate or caudate, more or less hairy on back, margins scabrous. Panicle thin but terminal portion usually pyramidal, branches triquetrous or subalate with long acicular bracts. Fem. glume about ·1″ long, broadly ovate scarcely keeled, midrib produced into a mucro, disc-margin with lanceolate acute thin brown lobes ·04″ long. (In the Manbhum specimens named by *Clarke* from our area the disc is thick with truncate margin but the nut has fallen and perhaps the lobes also.) Nut when young minutely velvety, ·1–·12″ long, subglobose or ellipsoid, obscurely trigonous, narrowed at apex, straw-coloured or brown, "nearly always obscurely reticulated, margins of reticulations microscopically brown-hispid, or finally glabrate almost shining," *Clarke*.

Rajmahal Hills, *Kurz*! Ranchi, *Clarke*! Manbhum, *Clarke*! (The Manbhum specimen is very like *S. annularis*, but is named by *Clarke*.) Fl., Fr. Sept.–Nov.

Var. **pubescens,** *Steud.* (sp.). Leaves often softly villous beneath. Rachis of panicles very hairy. Spkts. sometimes hairy.

Chota Nagpur, Hazaribagh, *Clarke*.

6. S. elata, *Thw.*

A much more robust herb than any of the preceding, often 4–5 ft. high, with stout rhizome (nodose as in *hebecarpa*) and polished stems often ·3″ wide. Leaves 12–20″ long, spreading 3-fariously, ·3–·6″ wide, their sheaths 3-winged. Panicle including the lower axillary partial panicles about 1 ft. long, partial and terminal panicles rigid pyramidal, 2–4″ long, rather dense but spikelets scarcely clustered, rhachides acutely angled or winged pubescent or scabrid. Spikelets solitary or 2 together in the axils of narrow lanceolate-setaceous bracts usually longer than themselves, branches of the partial panicles in the axils of similar but longer bracts and partial panicles in the axils of foliage leaves below. Fem. fruiting glume very broadly ovate, ·14″ long, midrib strong excurrent as a mucro, disc-lobes very short suborbicular. Nut broadly or globosely ovoid from a broad base, ·09–·15″ long, white, reticulate, reticulations (especially the transverse parts) raised with minute ferruginous hairs, ultimately glabrate, tip smooth glabrous.

Frequent in shady places and in the forests of Chota Nagpur! Mayurbhanj, elev. 3000 ft.! Fl., Fr. March–June.

In its young state before the panicle opens it looks, apart from the 3-farious leaves, very like a grass. Stems often straw-coloured with darker nodes. L. deep green with 3 prominent nerves especially the two lateral, tip caudate setaceous, margins scabrid, cutting. Tip of the sheaths (opposite to the blades) rounded with short dense brown hairs (deciduous with age), and this character carried up into the bracts of the inflorescence, especially on the inside of the spikelets, where it becomes more pronounced, is a good recognition mark. Fem. spkt. usually in the same axil as a male, ·15–·17″ long before fruiting (excluding the 3 very long pubescent stigmas), glumes 4, two uppermost sub-equal carinate. Male spikelet smaller on a pedicel above the female, glumes up to 6 or 8, lowest 2 empty, keeled mucronate, lowest ·08″, others about ·12″ long, ovate-lanceolate.

16. CAREX, *L.*

Rhizomatous, nearly smooth, grass-like herbs but stem often 3-quetrous and bearing leaves near the base only (upper leaves, if any, bearing parts of the inflorescence in their axils and being regarded as bracts). Inflorescence of simple, or more usually, panicled spikes which are female in their lower part and male in their upper part, or wholly 1-sexual. Flowers 1-sexual each solitary in the axil of a bract or "glume." Glumes usually numerous and imbricate all round the axis of the spike (these glumes are not considered homologous with the glumes of other Cyperaceæ but are probably bracts subtending a very reduced spikelet).* Female with an upper proper glume wrapping round and concealing the ovary, its margins entirely connate and forming the "utricle" which is more or less bottle-shaped, mouth of its neck or beak often shortly 2-fid. Stigmas 2 or 3 exserted from the neck. Male flower with 2–3 stamens without utricle or perianth. Nut compressed or 3-gonous, included in the utricle.

* Sometimes a slender rudimentary racheola occurs in the perigynium or utricle at the base of the ovary as in the allied genus *Kobresia* in which the utricle is split down one side. Both *Carex* and *Kobresia* are more abundant in temperate regions.

I. Stigmas 3. Nut 3-sided or not flattened:—
A. Spikes all 2-sexual, female flowers below, male above:—
1. Panicle elongate of distant axillary more or less pyramidal panicles with numerous very short spikes:—
a. Glumes ·06–·12″ ferruginous or brownish. Spikes not congested . . . . . 1. *cruciata.**
Utricle ellipsoid strongly ribbed suddenly contracted into a beak ¼–⅔ utricle. Gl. much shorter than utricle . . . . . *α. cruciata.*
Utricle small narrow-ellipsoid or ovoid, definitely nerved glabrous. Beak as long as utricle. Gl. small ovate as long as utricle (without beak) . . *β. filicina.*
Utricle narrow-ellipsoid acutely 3-gonous, strongly many-nerved, hairy fuscous-brown, beak scarcely ¼ utricle . . . . . *γ. plebeia.*
b. Glumes straw-coloured, spikes congested:—
Fem. gl. ·1–·12″ with distinct aristula. Utricle ellipsoid ·15″ with beak ⅓–⅔ body . . . . . 2. *strammentitia.*
2. Spikes only 1–5 on the few distant branches of the panicle:—
Spikes ovoid ·25–·3″ long, congested at top of stem . 3. *rhizomatosa.*
Spikes linear 1–3″, all distant . . . . . 4. *speciosa.*
B. Spikes 1-sexual, lower wholly female, terminal 1–3 male . 5. *Wallichiana.*
II. Stigmas 2. Nut much flattened:—
Lower spikes female drooping. Terminal wholly male . . 6. *phacota.*

1. C. cruciata, *Wahl.* Inc. C. plebeia, *Clarke*, C. filicina, *Nees.*

Stems many 2–3·5 ft. high sub-cæspitose from a stout branched horizontal rhizome which is covered with fibrous sheaths, 3-quetrous, smooth, attaining nearly ·1″ diam. Leaves many long, often overtopping the stems, upper passing into bracts, ·1–·25″ broad, ending in long setaceous scabrid tips, margins more or less scabrid, nerves usually two stronger than others as seen from above, about 5 subequal each side of midrib as seen from below, sheaths glabrous, lowest on stem sometimes without blades lanceolate cuspidate. Panicle about a foot long consisting of a number of axillary more or less pyramidal partial panicles 1·5–2·5″ long and terminating in an oblong or pyramidal panicle. Partial panicles with lateral branched spikes below, simple spikes above and terminating in an elongated spike, all spikes short with female glumes below spreading in fruit and a terminal cylindric male portion, ultimate lateral spikes ·25–·5″ long. Peduncle glabrous, rhachis and rhachides of spikes angled pubescent or hispid. Glumes brown ovate to lanceolate concave with strong midrib more or less excurrent as a mucro or awnlet, ·06–·12″ long with the awnlet. Utricle ovate acuminate or turbinate always beaked, the beak from one-quarter to as long as the rest of the utricle, more or less strongly ribbed closely clinging to the 3-quetrous nut, ·08–·15″ long (the difference in length mainly due to the variable beak), brown dotted.

A very common plant on banks and in shady places, probably throughout the province. Fl., Fr. Sept.–Jan.

A large number of species has been made of what I include under this. I briefly indicate their limits *as drawn up by Clarke* for the *F.B.I.*, but they seem to me to pass into one another in all directions and their separation to be quite useless and artificial:

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* As explained below, the above varieties are considered species in the *F.B.I.*

α. **cruciata,** *Wahl.* (sp.).

Utricle ellipsoid trigonous strongly ribbed suddenly contracted into a beak one-third to two-thirds the utricle. Glumes much shorter than utricle, ovate, minutely mucronate or not.

Singbhum, *Clarke*! Hazaribagh, *Clarke*! and also apparently specimens collected by myself belong here.

Clarke calls his specimens var. *nagporensis* and he further describes this variety as having "secondary panicles (my partial panicles) with suberect branches scarcely pyramidal, sometimes very slender, ripe utricle scarcely inflated fuscous-green often with black or red dots in upper half, beak subconic at base ½-⅔ utricle.* Utricles from glabrous to intensely scabrous."

The habit of the plants so named is different, one being with very thin (like *plebeia*) and the other with hispid-pubescent dense panicles. Spikes each with an acicular bract as long as itself ·2-·4″ long. Utricle in one specimen grey or hoary. Beak of utricle one-third to one-half as long as the whole length.

β. **filicina,** *Nees* (sp.).

Spikes small, often very many on slender branches, not congested, female glumes not (or scarcely) mucronate, utricle small narrow-ellipsoid or ovoid definitely nerved glabrous, beak linear about as long as utricle.

Parasnath, 3000 ft., *Clarke*.

The actual specimen so named has glumes ·06-·07″ long, mucronate! Utricle twice as long, ·14″ including the long beak which is scabrous or hispid and strongly ribbed.

γ. **plebeia,** *Clarke* (sp.).

Leaves narrow, partial panicles pyramidal slender, spikes brown, fem. gl. ovate acute scarcely mucronate, utricle narrow ellipsoid acutely trigonous strongly many-nerved hairy fuscous-brown, beak scarcely one-fourth length of utricle.

Chota Nagpur, alt. 1500-2000 ft. throughout the province!

A Ranchi specimen named by *Clarke* has glumes ·05-·06″ long with minute *fine aristula*. The lateral spikes are ·2-·3″ long only supported by filiform bracts as long, and in their axils is a remarkable semi-globose ribbed tubercle not commented on by *Clarke* but which also occurs in other specimens of my own as well as in specimens of *cruciata*! Utricle ·08-·12″ sharply beaked and ribbed, often hispid, beak nearly as long as the rest of the utricle or ·04″. In general it seems to me that *plebeia* can be distinguished from *cruciata* var. *nagporensis* by the much more delicate partial panicles with spreading glumes. *Kükenthal* (in *Pflanzenreich*) reduces *plebeia* to *continua* and includes *condensata* in *cruciata*. He might have gone much further in such reductions.

2. **C. stramentitia,** *Boott.*

Rhizome with fibrous sheaths. Stems and leaves 1–3 ft. Leaves up to ·5–·7″ wide, usually two of the side nerves stronger than the others above. Panicle of several pyramidal partial panicles as in the last, but straw-coloured and spikes congested. Fem. glumes ·1–·12″ long with a very distinct hispid aristula on most, sometimes as long as the blade. Utricle ellipsoid beaked 3-gonous many- (15–20-) nerved or -ribbed, ·15″ long with the beak half to two-thirds as long as the rest.

Ramnagar to Sikkim Tarai in the Northern Area, *King*, etc.! Manbhum, *Campbell*! Parasnath, 4000 ft., *Clarke*! Fl., Fr. April.

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* By utricle *Clarke* apparently means the utricle *without* its beak.

This species which is included in the *F.B.I.* between *cruciata* and *plebeia* is very distinct looking. The spikes are very dense. *Clarke* says "near *indica* but the characteristic setaceous bracteoles are wanting." It has, however, frequently setaceous bracts at the base of the spikes as long as the spikes as in the last species.

3. **C. rhizomatosa,** *Steud.*

A leafy sedge about 1 ft. high from a stout woody nodose horizontal rootstock which is densely covered with the fibrous bases of old leaf sheaths. Leaves on barren shoots 6–8″ flat keeled about ·2″ broad, glabrous except for the scabrid margins, those on flowering stems 1–2″ only. Fl. stems sub-terete with long erect distant flowering solitary or 2-nate branches its whole length, each in the axil of a leaf or bract. Lower branches 2–3″ long, upper shorter, bearing at the ends 1–5 short dense ovoid greenish or brown spikes ·25–·3″ long, congested at the top of the stem. Fem. glumes about 4–8 at base of spikes, ·1–·12″ long, lanceolate, green with scarious sides and an excurrent awn about one-quarter to one-third as long as the blade. Male glumes above the females ·17″, stamens 3–6. Utricle in flower ovoid with shortly tapering neck, in fruit 3-gonous broadly ellipsoid scabrous-hairy, fuscous-brown, obscurely 8–15-nerved, with 2-fid beak scarcely half as long as the rest.

Wet ground, most evident after the jungle fires. Pats of Ranchi and Palamau! Fl. May–June.
Lower bracts leaf-like as long as the peduncle, upper rather exceeding it.

4. **C. speciosa,** *Kunth.*

Stems slender few 8″ to 2 ft. high from a woody rhizome covered with fibrous sheaths, often overtopped by the long leaves which are from ·12–·75″ wide. Spikes pale few (3–1) and very remote on the stem, linear 1–3″ long, lower long- upper usually short-peduncled, female glumes below, male above. Fem. gl. ovate-oblong with triangular very acute tips, ·1″ long, midrib not very prominent, side nerves many. Utricle ·15–·17″, ellipsoid (ovoid pyramidal, *Clarke*) triquetrous, many-striate, slightly puberulous on the corners, acuminate, scarcely beaked. "Nut oblong-obovoid, two-thirds utricle, black, style short, base scarcely dilated," *Clarke*.

Rajmahal Hills, *Cal. Herb.*! Western Bengal and Behar (Parasnath). *Kurz*! Fl., Fr. Aug.–Sept.

5. **C. Wallichiana,** *Prescott.*

Erect, variable in height, 6–30″, stoloniferous with strongly 3-quetrous stems smooth or scabrous above and covered with split often purple sheaths at the base. Leaves overtopping the stem, flat, ·1–·2″ wide with a rigid filiform tip. Spikes 5–6, lower 2–3 distant female ·7–1·5″ long by ·15–·22″ broad, cylindric dense-flowered, shortly or, finally, long-peduncled. Upper 2–3 spikes male linear ·7–1·5″ long, close with lanceolate acuminate-aristate glumes pale-fuscous with green 3-costate back. Utricle exceeding the glumes ovoid-ellipsoid, dense-pubescent, turgidly 3-gonous, nerved, ·13–·14″

long without the short abrupt 2-fid beak which is divided nearly to the base into 2 lanceolate prickly teeth. Nut closely included elliptic 3-gonous stipitate. Stigmas 3.

Dumraon (Shahabad), *Ramyad Lal* ! Fl., Fr. Feb.-April. It is frequent in the Upper Gangetic Plain and extends to Sikkim.

6. **C. phacota,** *Spreng.*

Rather a handsome sedge about 2 ft. high with cæspitose 3-quetrous stems from a short woody rhizome and with brown sheaths at their base. Leaves glaucous, often as long as stem or exceeding it and attaining 3 ft., ·25–·3″ wide. Inflorescence consisting of several long drooping female spikes towards the top of the stems 2–3″ long in the axils of foliaceous bracts and a terminal erect brownish male spike. Fem. usually 4–5 on slender peduncles ·12–·25″ long, linear-cylindric, ·25″ diam., glumes oblong with an excurrent green linear 3-nerved centre, hispid above and white often brown-dotted sides, length including the excurrent cusp ·12″. Utricle much medianly compressed exceeding the glume in length and breadth, ovoid, or ell.-rhomboid, ·12–·14″ long, margined, faces hoary (brown in the herbarium) with close white papillæ, scarcely beaked. Stigmas 2.

In marshy places under shade, 2000 ft. Singbhum! Fl., Fr. March-June (also collected by me in the Central Provinces, both localities being an extension of its distribution over that given in the *F.B.I.*).

The papillæ or glands on the utricle turn red and come off on boiling.

FAM. 139. GRAMINEÆ.

Annual or perennial herbs (grasses) or suffruticose or with very large woody culms (bamboos). Stems or culms terete, hollow or solid between the transverse septa (knots or nodes), often swollen above the septum externally but inside the sheaths (culm nodes)* and sheath often with an annular swelling at the base which may become shrunk or discoloured with age (sheath nodes).* Leaves distichous ; sheath open or its margins overlapping, more rarely closed to the top ; a membranous scarious hard or hairy appendage (ligule) usually at junction within of sheath and blade, sometimes ligule obsolete. Flowers usually 2-sexual but often some 1-sexual and in a few genera diœcious, always much reduced, solitary in the axils of close imbricating sessile green or scarious or coriaceous bracts (glumes).† Glumes distichous and alternate on a minute axis "rhachilla" ; each separate system of glumes with the rhachilla is called a "spikelet." Spikelets spicate or racemed or variously panicled. Lowest 2 glumes ‡ (rarely

* The word "node" is usually sufficiently intelligible when referring to hairiness or other character and is then used without qualification.

† The glumes are distinguished by some authors into *glumes*, *i.e.* the lower empty ones and *florets*, *valves* or *flowering glumes*. The outer involucral glumes however often more resemble the first flowering than the flowering do one another and the morphology is the same. These same authors call the palea a valvule.

‡ The glumes are numbered consecutively from below upwards thus, i, ii, iii, etc., but if there are reasons to believe that any are suppressed the numbering is in accordance with their supposed position, *e.g.* if from comparison with allied species it is believed that gl. i is suppressed the lowest glume is numbered ii and so on.

only 1 or more than 2) normally empty, others usually flowering or at least with a bracteole (palea) normally opposed to the glume (but without any visible internode between) which is nerveless or often 2- rarely more-nerved or -keeled, never awned, sometimes absent or reduced. Empty or rudimentary glumes may also sometimes occur above the flowering. Within the palea and usually embraced by it the 2-sexual flower consists typically of (*a*) 0–3, usually 2, minute fleshy turgid scales—"*lodicules*"*—which are probably a rudimentary perianth (*Hackel* however considers them to be bracteoles), they are said to function by their turgescence in forcing open the glume and its palea (and they shrivel up and disappear after the anthers are empty); (*b*) stamens 1–6, usually 3, with versatile anthers usually emarginate both ends; (*c*) ovary 1-celled with 2 more or less free styles and plumose stigmas. Ovule anatropous. Embryo often large at the base of the seed but towards one side; plumule with several leaf-rudiments, cotyledon converted into the "scutellum" which remains in the seed to absorb the copious albumen.

In the arrangement of the Gramineæ I have begun with the Bambuseæ which show several primitive characters, the possession of the normal 2 whorls of stamens, the transition from bracts to glumes, etc., and have ended up with the highly modified and evolved Maydeæ.

In many respects I have been largely guided by Stapf in Fl. Trop. Africa.

KEY I. TO GROUPS (and the genera of uni-generic tribes).†

I. Tall stout woody grasses (Bamboos), stems hollow, very rarely sub-solid between the nodes. Stamens 6 (in our spp.). Empty gls. 2-more scarcely differentiated from the basal bracts of spkt. and usually increasing in size to the flowering. Fl. gls. 1-several. Palea usually large. Lodicules often 3. Gen. 1-4 . . . . . 1. **Bambuseæ.**

II. Herbaceous, rarely suffruticose with hollow or solid culms. Empty glumes 2-1 (rarely 0), not passing into basal bracts. Stamens 3-1 (exc. *Oryzeæ* 3-6). Lodicules 2 or 0. Gen. 5-end:—

A. Spkts. not articulate on their pedicels or on the rhachis joints. (Exc. in some *Eragrosteæ* and *Agrosteæ*, and then spkts. with 3 glumes only and rhachilla articulate or many glumes. See also *Zoysieæ*.) (To p. 940):—

1. Fl. glumes 1-many, all 2-sexual or uppermost imperfect. Rhachilla usually articulate above gls. i and ii and often at base of other glumes, sometimes produced beyond the last glume. Gl. iv rarely crustaceous in fruit (*Cælachne*). Gen. 5-29 . . . . . *POACEÆ.*

a. Very large grasses (Reeds). Spkts. pedicelled in large decompound panicles. Rhachilla jointed. Fl. gls. 3-8, narrow, 3-nerved. Gen. 5-7 . . . . . 2. **Arundineæ.**
(For another large Reed-like grass see *Thysanolæna*.)

b. Moderate-sized or small grasses. Panicles not decompound or if so then fl. gls. either broad or only 1-2. Gen. 8-29:—

* Where the number of the lodicules is not given it is assumed to be two. More than 2 are only found in the Bambuseæ.

† Groups ending in *-astræ* are sub-tribes.

i. Spkts. 2-more fld. or if 1-fld. then gls. 5-nerved:—
† Spkts. not clustered nor spicate or if spicate (few *Eragrosteæ*) then gls. many similar broad:—
Fl. gls. 3-7-nerved or nerveless, gls. i and ii not much shorter than the spkt. Awn geniculate or 0. Gen. 8, 9 . . . . . 3. **Aveneæ.**
Fl. gls. 3-nerved, usually many, awnless, entire or toothed. Gls. i and ii much shorter than the spkt. Gen. 10–12 . . . . . 4. **Eragrosteæ.**
†† Spkts. very minute 3-5-fld. in globose clusters on an elongate simple rhachis and subtended by imperfect spkts. . . . . Genus 13. *Elytrophorus.*
††† Spkts. large sessile 1-more-nate in the notches of a simple rhachis. Flg. gls. 5-9-nerved. Gen. 14, 15 . . . . 5. **Hordeæ.**
ii. Spikelets 1-fld. or if more than 1-fld. then upper fls. imperfect or spkts. in digitate spikes or minute 1-3 fld. and sunk in a simple rhachis (*Oropetium*) or (*Sporobolus*) 1-2-fld. and gl. iii 1-nerved:—
† Spkts. 1-more-fld., 2-seriate and secund on the spiciform branches of a slender panicle or on a simple spike (clustered in *Gracilea*). Fl. gls. all or the lower only 2-sexual. Rhachilla produced or not. Gen. 16–24 . . . . . 6. **Chlorideæ.**
†† Spkts. 1-fld. (rarely 2-fld. in *Sporobolus*) panicled. Gls. 3 only (rarely 4 in *Sporobolus* and then rhachilla jointed at base and gl. iv not hardening as in *Paniceæ*). (Spkts. jointed on their pedicels in *Garnotia* and *Polypogon* and *Sporobolus*.) Gen. 25–29 . . 7. **Agrosteæ.**

2. Glumes normally 4 or i and ii obsolete, iii imperfect or male. Flg. glume hardening or not in fruit.
* The following genera 30–32, 36–38 are usually included in the *Panicaceæ*. They are somewhat intermediate in character between the two groups. In *Perotis* and *Zoysia* the spkts. *are* jointed on a simple rhachis, but there is only 1 fl. gl.:—
a. Spkts. not articulate on the pedicels, but pedicels articulate and upper part or whole falling with the spkts., or in *Perotis* and *Zoysia* spkts. articulate on a simple rhachis *PANICACEÆ.*
i. Spkts. spicate, 1-fld. only. Gls. 2-3 only . 8. **Zoysieæ.**
ii. Spkts. in decompound panicles with 4 glumes, obscurely jointed on pedicel, but falling with part of pedicel iii empty hardening, iv membranous with stiff hairs. A large Reed-like grass Genus 36. *Thysanolæna.*
b. Neither spkts. nor pedicels articulate. Gls. 4. Gls. i and ii usually separately deciduous. Gl. iv subcoriaceous or hardening in fruit, articulate at base:—
Spkts. lanceolate or oblong. Gl. iv smallest, lanceolate, subcoriaceous and scaberulous in fruit . . . . . Genus 37. *Arundinella.*
Spkts. small or minute subglobose or obovoid. Gls. iii and iv similar, usually both fertile,

iv hemispheric, coriaceous in fruit, never awned . . . . . Genus 38. *Isachne.*

B. Spikelets distinctly articulate on their pedicels and falling from them or from the joints of an articulate rhachis when mature. Glumes normally 4, i and ii rarely suppressed. Gls. iii and iv both flowering or iii empty or paleate, often male. iv always 2-sexual (exc. in *Spinifex* and *Maydeæ*, *q.v.*). *Cp.* p. 938:—

1. Rhachis of inflorescence inarticulate. Flg. gl. well developed, usually coriaceous or chartaceous in fruit. Gl. i and ii sometimes reduced:—

a. Spkts. 1-fld. Gls. i and ii often reduced to a rim or 0. Stamens 6, more rarely 3. Gen. 33–35 . . . . . 9. **Oryzeæ.**

b. Spkts. 2-fld., upper fl. 2-sexual, lower male or neuter, rarely both fertile or spkts. dicœcious. Gl. iii generally like ii in structure and nervation; iv rarely finely awned (*Alloteropsis* spp.). Stamens 3–1 (genera 36–38 also included in *Panicæ*) . . . **Paniceæ.**

i. Spikelets 2-sexual:—

† Spkts. falling in groups or if singly then subtended by an involucre of bristles (*Cenchastræ*) . . . . . Genus 39. *Pennisetum.*

†† Spkts. falling singly and entire from the rhachis or persistent pedicels, not awned or if awned then similar and in secund spikes and the awn from the entire tip of gls. ii and iii (*Echinochloa*) or from the tips of i or ii (*Oplismenus*):—

‡ Gl. iv crustaceous in frt. with inrolled margins embracing the similar palea; palea of iii if developed not attached to the fruit. Gen. 40–50 . . . . . 10. **Panicastræ.**

‡‡ Gl. IV with usually flat to hyaline margins, in fruit thinly cartilaginous, with the usually minute palea of iii attached to its base. Inflor. of digitate or subdigitate or somewhat distant spikes. Gen. 51–52 . . . . . 11. **Digitariastræ.**

ii. Dicœcious. Suffruticose. Male spkts. 2-fld. articulate in rigid umbellate spikes. Fem. in large globose heads of stellately spreading quill-like rhachises, one spkt. at the base of each . . . . . Genus 53. *Spinifex.*

2. Rhachis of spikes usually articulate and spkts. normally in pairs sessile and pedicelled, rarely one of a pair suppressed (*Dimeria*) or both pedicelled, or spkts. in triplets (1 sess. and 2 pedicelled). Spikes simple or variously arranged. Sessile spkts. (exc. sometimes the basal) 2-sexual or female. Gls. i and ii firmer than iii or iv, iv hyaline, often reduced to the hyaline base of an awn. (Ped. spkts. usually fall from their pedicels. Sess. spkts. fall with the collateral joint of the rhachis and its companion pedicel. Rhachis rarely tenacious or fused with pedicel). . . . . **Andropogoneæ.**

a. Joints and ped. not bulbous or adnate with one another, if thick then spikes digitate or in spathaceous panicles. Sess. spkts.

usually 1-fld. and awned (2-fld. in some *Ischæmastræ*). Gen. 54–80:—

i. All spkts. alike in shape and sex or if unlike then palea very short:—

† Spikes in compound panicles or racemously arranged on an elongate common axis. Spkts. 1-fld. Gl. iv awnless or awned from the entire tip or from the sinus of a 2-toothed tip. Gen. 54–55 . . . . . 12. **Saccharastræ.**

†† Spikes digitate or solitary, 1-fld. or if 2-fld. then glume i channelled:—

‡ Rhachis marticulate. Spkts. not paired . . . . . Genus 56. *Dimeria.*

‡‡ Rhachis articulate:—

Spkts. in solitary terminal capillary spikes, 2-awned . . Genus 57. *Pogonatherum.*

Spkts. in digitate spikes 1- or 2-awned. Gen. 57–60 . . . . 13. **Polliniastræ.**

ii. Sess. and pedicelled spkts. dissimilar or if similar (*Pollinidium*) palea well developed and rhachis compressed. Sess. spkt. 2-sexual, ped. male, empty or 0:—

† Fertile spkts. 2-fld.:—

Both spikelets awned. Joints and pedicels often flattened or thickened. Palea well developed . . . . 14. **Ischæmastræ.**

Pedicelled spkt. reduced to its pedicel Genus 64. *Apocopis.*

Sessile spkt. awnless. Gl. i 3-toothed. Ped. spkt. awned . . . Genus 65. *Lophopogon.*

†† Fertile spkts. 1-fld.:—

‡ Panicles espatheate (spikes not subtended by spathes):—

§ All pairs of spkts. alike, in simple or compound panicles:—

‖ Gl. iv awned from low down on back. Spikes digitate Genus 66. *Arthraxon.*

‖ Gl. iv awned from the tip or sinus:—

Gl. iv reduced to the hyaline stipitiform base of the awn. Joints and pedicels filiform with a depressed translucent middle line. Gen. 67, 68 . 15. **Amphilophiastræ.**

Gl. iv 2-cleft with awn from the sinus. Joints and pedicels solid (slightly mesially translucent in *Sorghum fasciculare*). Gen. 69–71 . . . 16. **Sorghastræ.**

§§ Lowest pair or pairs of spikelets differing from all those above them, homogamous (male or neuter). Joints and pedicels solid:—

Spikes digitate, rarely solitary. Sess. spkts. dorsally compressed. Gl. iv a naked awn acute at the base . . . . 72. *Dicanthium.*

Spikes solitary. Sess. spkt. subcylindric. iv a long very stout awn and often a hyaline base. Callus of sess. spkt. pungent . 73. *Heteropogon.*

‡‡ Panicles spatheate. Spikes usually 2–1 (rarely more) on a common peduncle which is closely sheathed

by a spathaceous leaf-sheath (spatheole), from which it is usually only shortly exserted (peduncle elongate in *Andropogon apricus*) :—

§ Spikes not reduced to a central few-noded portion surrounded by an involucre of male or neuter spkts. :—

‖ All pairs of spikelets similar to one another :—

* Spikes solitary in each spatheole :—

Joints and pedicels slender . 74. *Hypogynium.*

Joints and pedicels buccini-form. Gen. 75, 76 . . 17. **Schizachyriastræ.**

** Spikes geminate in the spatheole . . . . . 77. *Andropogon*.*

‖‖ Lowest pair of spkts. on one or both of the geminate spikes homogamous. Lowest joint often much thickened. Panicles decompound. Often aromatic grasses . . . . 78. *Cymbopogon.*

§§ Spikes reduced to a central few-noded portion surrounded by an involucre of modified, male or neuter, spkts. Gen. 79, 80 . 18. **Themedastræ.**

b. Spike reduced to three spikelets with a bulbous base on a slender peduncle in spathaceous panicles . . . . . 81. *Apluda.*

c. Spikes many-noded. Joints and pedicels or at least the joints much swollen and often forming a cylindrical axis in which glume i is sunk in a depression formed by the internode and pedicel of the ped. spkt. Pedicelled spikelet sometimes entirely suppressed. Gen. 82-86 . . . . . 19. **Rottboelliastræ.**

3. Male and female spikelets in different inflorescences on the same plant or occupying different parts of the same inflorescence; females below, often solitary with or without a rudimentary ped. spkt., 1-fld. Males in pairs, one sessile the other pedicelled at the top of the inflorescence. Female lower glume or bracteole often becoming hard or bony. Gen. 87-90 . . 20. **Maydeæ.**

KEY II. TO GENERA IN THE GROUPS.

Group 1. **Bambuseæ.** Bamboos.

A. Pericarp fleshy or crustaceous free from the seed :—

Spkts. 1-fld., bracteate. Fruit beaked . . . . 1. *Cephalostachyum.*

Spkts. 2-many-fld., 1 only usually fertile. Ovary hirsute at the tip . . . . . 2. *Dendrocalamus.*

B. Pericarp thin, adnate to the seed :—

Filaments free. Spkts. 1-many-fld. Palea 2-keeled . 3. *Bambusa.*

Fil. connate. Spkts. few-fld. Palea 0 or not keeled . 4. *Oxytenanthera.*

Group 2. **Arundineæ.** Reeds.

A. Spkts. 3-7-fld. Rhachilla with very long hairs. Gls. glabrous . . . . . 5. *Phragmites.*

B. Rhachilla with short hairs below the flg. gls. or glabrous. Flg. gls. toothed and awned :—

Gls. i and ii 1-nerved. Flg. gls. marginally hairy . 6. *Triraphis.*

Gls. i and ii 3-nerved. Flg. gls. dorsally hairy . . 7. *Arundo.*

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* *Andropogon* and *Cymbopogon* both belong to the *Andropogonastræ* and are very closely allied. Indeed some *Cymbopogon* have none of the sessile and pedicelled spikelets similar nor strictly homogamous. The habit is however different.

Group 3. **Aveneæ.**
Spkts. 2-more-fld., awned . . . . . 8. *Avena.*
Spkts. 2-fld., awnless. Gls. membranous . . . . 9. *Cœlachne.*

Group 4. **Eragrosteæ.**
A. Flg. gls. entire:—
Spkts. panicled or 2-seriatim spicate, not jointed on rhachis . . . . . 10. *Eragrostis.*
Spkts. sessile and jointed on the short crowded branchlets of a tall narrow racemiform panicle . . . 11. *Desmostachya.*
B. Fl. gls. 3-4-toothed . . . . . 12. *Diplachne.*

Group 5. **Hordeæ.** Wheat and Barley.
Spkts. solitary at the nodes. Fl. gls. few, 5-9-nerved . 14. *Triticum.*
Spkts. clustered at the nodes. Spkts. 1-fld. Fl. gl. 5-nerved . . . . . 15. *Hordeum.*

Group 6. **Chlorideæ.** Marua, Dub-grass, etc.
A. Spike solitary, terminal:—
1. Spkts. minute, more or less sunk in the rhachis, 1-3-fld. Gl. i minute or 0. iii hyaline . . . 16. *Oropetium.*
2. Spikelets not sunk in the rhachis:—
a. Spikelets awnless, minute, unilateral on flattened rhachis, 1-fld. . . . . 17. *Microchloa.*
b. Spikelets awned:—
Spkts. 1-2-fld. in pedicelled articulate clusters . 18. *Gracilea.*
Spkts. many-fld. Fl. gls. 3-awned . . . 19. *Tripogon.*
B. Spikes digitate, spicate or racemed (rarely only 1 in *Chloris*):—
1. Spkts. awnless, 1-fld. Spikes digitate . . . 20. *Cynodon.*
2. Spkts. awned (exc. *Leptochloa*):—
a. Spkts. 2-nate secund on geminate, fascicled digitate or whorled terminal erect or radiating spikes:—
Glumes 3, iii flg. and one or more reduced differently shaped neuters (sometimes reduced to awns) . . . . . 21. *Chloris.*
Spkts. 3-12-fld. . . . . 22. *Eleusine.*
b. Spkts. in racemosely arranged spreading or deflexed finally deciduous spikes. Fl. gls. thin, obtuse or emarginate shorter than the empty glumes . . . . . 23. *Dinebra.*
c. Spikes panicled, filiform. Spkts. very minute, alt. 1-more-fld., awnless . . . . . 24. *Leptochloa.*

Group 7. **Agrosteæ.**
I. Glumes thin or membranous:—
A. Spikelets persistent on their pedicels (with gls. i and ii):—
Gl. iii 5-nerved. Spkt. 1-fld. . . . . 25. *Agrostis.*
B. Spikelets jointed on their pedicels (jointed but not falling in *Polypogon*):—
1. Spkts. awnless. Gl. iii 1-nerved . . . . 26. *Sporobolus.*
2. Spikelets awned:—
Spkts. 1-2-nate, not laterally compressed, panicled . . . . . 27. *Garnotia.*
Spkts. laterally compressed, keeled, crowded on the short branches of a spiciform panicle. Gl. iii hyaline . . . . . 28. *Polypogon.*
II. Fl. glume rigid or hard, usually awned, tightly wrapping round the fruit. Awn sometimes 3-branched. . . . . 29. *Aristida.*

Group 8. **Zoysieæ.**
A. Gls. 3, narrowly linear, 1-nerved, awned. Spkts. articulate on rhachis . . . . . 30. *Perotis.*
B. Glumes 2 only. Spkts. articulate on the rhachis or not:—
Glumes both thickly coriaceous, 5-ribbed and spinous . 31. *Tragus.*
Gl. i coriaceous, shining nerveless, ii membranous . 32. *Zoysia.*

Group 9. **Oryzeæ.** Rice, etc.

A. Gls. i and ii minute or setaceous, iii chartaceous, strongly 3-5-nerved . . . . . 33. *Oryza.*

B. Glumes i and ii absent:—

Gls. iii and iv broad thin. Awnless . . . . 34. *Leersia.*

Gls. iii and iv narrow thin. Awned . . . . 35. *Hygrorhiza.*

Group 10. **Panicastræ.**

I. Inflorescence an open, contracted cylindric or spiciform panicle:—

A. Spikelets, or at least the upper on each branchlet subtended by 1-more bristles . . . . . 40. *Setaria.*

B. Spikelets not subtended by bristles:—

1. Spkts. usually somewhat gibbous, in spiciform panicles, the branches of which are more or less adnate to the axis (so that the pedicels appear to spring more or less directly from the axis) . . . . . 41. *Sacciolepis.*

2. Branches of panicle not adnate to the main axis:—

Panicle much contracted, dense, very compound with erect narrowly lanceolate spkts. Gl. iii tapering into a beak; iv rather thin . . . 42. *Hymenachne.*

Panicle usually open. Gl. iii not beaked, iv crustaceous . . . . . 43. *Panicum.*

II. Inflorescence of variously arranged usually secund spikes. Spkts. mostly paired, unequally pedicelled, or solitary and alternately to right and left of the median line of a dorsiventral rhachis:—

A. Glumes caudate, awned or cuspidate acuminate:—

Gls. cuspidate or awned from the entire tip. Gl. i not awned . . . . . 44. *Echinochloa.*

Gls. awned from slightly notched tip. Gl. i long-awned . . . . . 45. *Oplismenus.*

B. Glumes neither awned nor caudate, if cuspidate then abruptly so from the rounded or obtuse gl. iv, and margins of iv inrolled all along:—

1. Gl. i, if present abaxial, back of fruit adaxial*:—

a. Gl. i absent or reduced to a minute scale. Spkts. conspicuously plano-convex . . 46. *Paspalum.*

b. Glume i often small but distinctly developed:—

Spkts. solitary, closely 2-seriate, laterally contiguous in rigid spikes. Gl. iv acute in fruit 47. *Paspalidium.*

Spkts. solitary or paired, when solitary dorsally contiguous, in often flexuous spikes. Gl. iv obtuse or rounded and cuspidate in frt. 48. *Urochloa.*

2. Gl. i, if present, adaxial. Back of fruit abaxial:—

Gl. i small. Gl. iv acute. Spikes usually racemed 49. *Brachiaria.*

Gl. i rudimentary, forming with base of rhachilla a knob-like callus . . . . . 50. *Eriochloa.*

Group 11. **Digitariastræ.**

Spkts. awnless. Gl. i minute rarely 0; iii usually with 5–7 close straight prominent nerves . . . . . 51. *Digitaria.*

Spkts. awned. Gl. iii more or less hardened and like iv . 52. *Allotaropsis.*

Group 12. **Saccharastræ.** Sugar-cane, etc.

Rhachis of racemes tough, racemes in dense thyrsoid solitary villous panicles. All spkts. pedicelled, awnless 54. *Imperata.*

Rhachis of racemes readily disarticulating. Panicles thyrsoid or with distinct whorls of branches. Spkts. sessile and pedicelled, often awned . . . . . 55. *Saccharum.*

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* Where gl. i is *adaxial*, *i.e.* the nearest of all the glumes to the rhachis, it follows that the back of the fruit will be turned away from the rhachis or *abaxial*, and *vice versâ*. Thus in *Paspalum* the flat side is outwards or turned away from the rhachis, the back is convex and faces the rhachis.

Group 13. **Polliniastræ.**
A. Glume i not dorsally grooved:—
Sess. spkt. gl. ii awnless; iv very short, 2-lobed. Perennial . . . . . 58. *Eulalia.*
Sess. spkt. gl. ii awned. iv narrow-oblong 2-fid or 2-toothed. Annual . . . . . 59. *Puliculum.*
B. Gl. i dorsally channelled, iv minute entire or 2-toothed 60. *Pollinia.*

Group 14. **Ischæmastræ.**
A. Rootstock and base of stems clothed with woolly sheaths:—
Rhachis of spkts. flattened. Spkts. similar and homogamous . . . . . 61. *Pollinidium.*
B. Stem not woolly below. Joints and pedicels stout. Spkts. heterogamous:—
Spikes clustered. Gl. i not channelled . . . . 62. *Ischæmum.*
Spikes solitary. Gl. i mesially channelled . . . 63. *Sehima.*

Group 15. **Amphilophiastræ.**
Racemes in compound panicles . . . . . 67. *Capillipedium*
Racemes subdigitate or fascicled or subverticillate on an elongate central axis . . . . . 68. *Amphilophis.*

Group 16. **Sorghastræ.**
A. Primary branches of panicle whorled, racemes of many pairs of spkts. Gl. i coriaceous, muricate (in our sp.) 69. *Vetiveria.*
B. Racemes of few pairs of spkts. (rarely 6), sometimes reduced to 1 sess. and 2 ped. Gl. i not coriaceous or muricate, or old sometimes coriaceous:—
Spkts. dorsally compressed. Ped. spkt. sometimes reduced to the pedicel. Sess. spkt. awned or not . 70. *Sorghum.*
Spkts. usually laterally compressed nearly always reduced to 1 sess. and 2 ped. on the tips of the peduncles, awned . . . . . 71. *Chrysopogon.*

Group 17. **Schizachyriastræ.**
Ped. spkt. much larger than the sess. Sess. gl. i linear; ii awned . . . . . 75. *Diectomis.*
Ped. spkt. subequal or smaller than sess. Sess. gl. i oblong coriaceous. Gl. ii awnless . . . . . 76. *Schizachyrium.*

Group 18. **Themedastræ.**
Central spikelets jointed on rhachis and deciduous leaving the involucral spkts. on the peduncle . . . . 79. *Themeda* (*Anthistiria*).
Whole cluster jointed below the involucral spikelets and falling together from the short peduncle . . . . 80. *Iseilema.*

Group 19. **Rottboelliastræ.**
A. Sessile and pedicelled spkts. very dissimilar. Sessile globose . . . . . 72. *Manisuris.*
B. Sessile and pedicelled spkts. subsimilar and flattened or ped. spkt. obsolete:—
1. Spike readily disarticulating; subterete:—
a. Gl. i convex. Ped. spkt. completely suppressed and the pedicel fused with the internodes . 83. *Ophiurus.*
b. Gl. i flat. Ends of the joints cupular or deeply hollowed out:—
Ped. spkt. distinct and its pedicel only partially adnate . . . . . 84. *Rottboellia.*
Pedicelled spkt. suppressed, its fused pedicel rarely bearing a rudimentary glume. Fertile spkts. opposite and deeply sunk in cavities, only separated by a thin evanescent membrane . . . . . 85. *Mnesithea.*
2. Joints coherent, tips truncate. Spikes compressed 86. *Hemarthria.*

Group 20. **Maydeæ.** Maize, Job's Tears, etc.
A. M. and Fem. spikes not in separate inflorescences (or rarely terminal inflorescence wholly male):—
Fem. spkts. often several at base of spikes, male spkts. at top. Fem. gl. i hardening, only open by a ventral slit . . . . . 87. *Polytoca.*

Male spikes projecting from the top of a globose or ellipsoid closed bract which contains one fem. spkt. with membranous gls. and is finally of stony hardness . . . . . 88. *Coix.*

B. Male spkts. numerous in terminal panicles. Fem. spikes fascicled in the axils of foliage leaves and with large coriaceous bracts. Stigmas very long:—

Fem. spikes of each cluster free from one another, jointed . . . . . 89. *Euchlæna.*

Fem. spikes of each cluster entirely fused by their axes into a club-shaped radial inflorescence, common rhachis non-articulate, very thick . . . . 90. *Zea.*

1. CEPHALOSTACHYUM, *Munro.*

Large or shrubby bamboos with slender straight stems. Stem-sheaths auricled. Leaves shortly petioled. Spikelets in terminal globose heads, or a panicle of bracteate heads, 1-fld., elongate, rhachilla produced beyond the flg. glume; empty glumes 2–3, broad, chaffy, many-nerved, usually long awned; flg. gls. more membranous, convolute, awns shorter; palea thin, many-nerved, keels 2 approximate. Lodicules 3, 3–5-nerved. Stamens 6, free, anthers long. Ovary stipitate, ovoid, narrowed into a long thickened style, stigmas 2–3, plumose. Grain oblong, beaked, pericarp separable.

1. C. pergracile, *Munro.*

A moderate-sized handsome cæspitose bamboo with culms rarely exceeding 2–2·5″ diam. in our area, 30–40 ft. high, glaucous and whitish below the scarcely thickened nodes, internodes slender, often 18″ with very thin walls. Stem sheaths short with rounded, long-fringed auricles light-brown soon deciduous, 4–6″ long, young with felted deciduous shining black hairs, afterwards much polished and a bright brown. Leaves 6–14″ by 1–2·5″, linear-lanceolate, shortly sparsely hairy on both surfaces or glabrescent, sub-glaucous beneath, sheath glabrous except on margins of the small auricles which are ciliate or (in one specimen) with stiff setæ ·25″ long, callus small ciliate. Panicle large, spikelets in bracteate clusters forming filiform drooping spikes, gls. 3–4, lower 1–2 sterile, fertile solitary densely hairy, terminal sterile; palea long 2-fid, anthers obtuse purple.

Deep ravines and valleys in Singbhum but rare (Luia in the Kolhan, Kiringkalor in Porahat and a few places in Saranda)! Fls. gregariously and sporadically. Deciduous.

Blade of stem-sheaths triangular acuminate 2″ only long, felted within towards the base and with densely fimbriate setose sometimes reflexed auricles, ligule very narrow. Leaves with rounded or cuneate base, midrib conspicuous, side nerves 6–12 each side, sparingly tessellate between.

The green culms split and crack in drying in Chota Nagpur, but *Gamble* says they are used for building in Burmah.

2. DENDROCALAMUS, *Nees.*

Large or mod.-sized unarmed bamboos with densely branching root-stocks. Leaves shortly petioled, transverse nervules represented by pellucid glands. Spikelets in globose clusters on the long branches of a compound panicle, ovate, 2–6-fld.; empty glumes 2–3, ovate, acute, many-nerved; flg. gls. like the empty; palea of lower fls. keeled, of

upper dorsally rounded eciliate. Lodicules 0 or rare. Stamens 6, filaments free. Ovary hairy above, often depressed, stigma usually simple. Grain small, pericarp coriaceous or crustaceous.

A. Spikelets hard, spinescent, crowded in heads, which are interruptedly spicate on the panicle-branches. Leaves narrow:—
Spkts. pubescent or hairy, anthers apiculate . . . . 1. *strictus*.
Spkts. silkily hairy or hirsute, anthers obtuse . . . . var. *sericeus*.
B. Spikelets in large soft congested heads:—
Leaves large broad, culms very large . . . . . 2. *Hamiltonii*.

1. D. strictus, *Nees.* Buru-madh or mat', *K., S.*; Salimbo, Saliabans, *Or.*

A gregarious, more or less cæspitose bamboo with culms 20–50 ft. high and 1–3″ diam., the central cavity usually comparatively small, sometimes 0. Lower stem-sheaths 3–12″ oblong, top rounded or waved, not or only slightly auricled, blade lanceolate not very distinctly differentiated on the outside, the striæ passing continuously into the sheath, on the inside with a very narrow ligule. Leaves narrowly oblong slightly narrowed from the rounded base (where it suddenly contracts into the short petiole) to the twisted subcuspidate tip, pubescent beneath, nerves 3–6 each side of midrib, transverse nervules reduced to pellucid dashes rather obscure when dry, sheath striate hairy or glabrous. Spikelets ·25–·5″ long forming globose spinescent heads at intervals along the branchlets, fertile and smaller sterile spkts. intermixed, empty glumes 2 or more ovate spinescent or muticous, many-nerved, flg. gls. about 2 ovate spinescent and pubescent at tip; palea of lower 6–7-nerved between the ciliate keels, anthers apiculate.

The commonest wild bamboo in the province but confined to the hills where it is sometimes gregarious to the exclusion of all else. Kymore Hills! Rajmahal Hills! Throughout the hill forests of Chota Nagpur, especially Porahat! Puri (Bhainsgot Hill, etc.)! Angul (common in Durgapur forests especially)! Sambalpur, common! It flowers nearly every year sporadically in Nov. Deciduous in the hot season.

A most useful bamboo and very strong but the culms in Behar and Orissa are not as solid as in dryer provinces and have not been marketable for lance-shafts. The new shoots are eaten. It is easily raised from seed. The best culms are always found where the bamboos have been least cut.

Var. **sericeus.** Syn. D. sericeus, *Munro* (sp.).

Characters of the type but spikelets silkily hairy or hirsute, anther-tips obtuse.

Hazaribagh, summit of Parasnath 4000 ft. *J.D.H.*, etc.

The heads are only ·6–·7″ diam. and those of *D. strictus* usually 1·2″ but smaller heads are very often found in *strictus* and the pubescence is also variable.

2. D. Hamiltonii, *Nees & Arn.*

A very large bamboo with stems up to 80 ft. high and 4–7″ diam. much branched above and often rather straggling, the nodes often with rootlets or root-scars, internodes 12–20″ long with relatively thin walls only ·5″ thick and large lumen. Stem sheaths glabrous or nearly so, truncate with acute auricles, blade lanceolate acute with a small glabrous triangular point on each side, often 12″ long with incurved margin and black bristles at base within. Leaves large or

small on side branches, often 15″ by 2·5″ on new shoots, broadly lanceolate cuspidate with rounded shortly petioled base and finely serrate margin. Panicle very large, branches scabrous and white-pruinose. Spikelets in hemispheric heads ·5–1·5″ diam., nearly ·5″ long, ovoid purple glabrous, empty gls. usually 2 short rounded, flg. gls. 2–4 orbicular, margins ciliate, anthers purple with a long black hairy twisted point.

A common tropical Himalayan bamboo, rare in our area. N. Champaran, on the Nepal boundary in the Sameshwar Hills! It flowers sporadically.

The young shoots are eaten. The large size of the internodes and lumen make it very useful as water pipes and like other bamboos it is used for a variety of purposes.

3. BAMBUSA, *Schreb.*

Usually large and cæspitose bamboos, rarely shrubby or with scattered culms. Stem-sheaths broad, blade often triangular. Leaves shortly petioled not tessellate by nervules, but sometimes by pellucid glands (*fide Gamble*; I have seen no anatomical investigation of these marks), sheaths auricled. Inflorescence generally a large leafless panicle bearing heads on spiciform branches, or of leafy panicles, or panicled spikes. Spikelets 1–many-flowered; lower gls. 1–4 empty or gemmiferous; fl. gls. ovate-lanceolate, uppermost imperfect; palea 2-keeled. Lodicules 2–3, membranous, ciliate, rarely 0. Stamens 6. Ovary oblong or obovate, tip hairy; style long or short, stigmas 2–3. Grain oblong or linear-oblong, furrowed on one side; pericarp thin adherent.

I. Branches unarmed:—
  A. Large bamboos, culms 2″ diam. and more:—
    1. Spikelets terete in loose heads. Leaves 6–10″ long by ·75–1·5″ wide, glaucescent and puberulous beneath:—
      Cæspitose. Palea not ciliate. Anths. obtuse . . 1. *tulda.*
      Culms solitary. Palea long-ciliate. Anthers apiculate . . . . . 2. *nutans.*
    2. Spikelets flattened in dense heads:—
      L. 1–2″ wide. Nodes with a white ring below, swollen 3. *balcooa.*
      Culms often yellow streaked. L. under 2″ wide. Nodes hardly raised without white band . . . 4. *vulgaris.*
  B. Shrubby, culms not exceeding 1″ diam. . . . . 5. *nana.*
II. Branches spinescent. Very large bamboos . . . . 6. *arundinacea.*

1. **B. tulda,** *Roxb.* Talda bans, *Beng.* (also djowa, mitenga, matela); Peka, *H.* (*fide Roxburgh*); Ropa-mat, *S.*; Pepe siman, *K.* (f. *Gamble*).

A very large bamboo attaining 70 ft. in height and 2–4″ diam.; cæspitose, internodes 1–2 ft. white-ringed below the nodes with walls ·3–·5″ thick. Stem-sheaths 6–9″ long by 6–10″ broad (when unrolled), gradually narrowed upwards with mouth sub-truncate rounded or subtriangular; blade with coarsely fringed auricles and hairy within, triangular or broadly lanceolate cuspidate. Leaves linear-oblong or -lanceolate, 6–10″ by ·75–1·5″, base usually rounded, tip subulate twisted, glaucescent and puberulous beneath. At flowering time the whole plant becomes a huge leafless panicle or the flowering is confined to short leafy panicles or spiciform branches. Spikelets 1–3″

long in interrupted clusters or loose heads mixed with chaffy bracts, usually 1–2-bracteolate, not flattened; gls. i to iii or iv acute, many-nerved, usually gemmiparous, the next 4–6 flowering ·5–1″ long, ovate acute acuminate or mucronate, palea shorter cymbiform, anthers obtuse glabrous purple, ovary obovate-oblong.

Widely cultivated and perhaps wild in the Santal Parg. (on the Rajmahal Hills! but see remarks under *B. nutans*). Flowers gregariously and in single clumps.

Stem-sheaths glabrous, hairy or white powdered. L. with faint pellucid glands, lateral (principal) nerves 6-10 each side; petiole often hairy; its sheath glabrous, ending in a smooth callus and oblong fringed auricle; ligule narrow, obscure. Rhachilla clavate, flattened, fragile; palea 5–7-nerved between the keels, tip penicillate. Lod. 3.

2. **B. nutans,** *Wall.* Makor, *Mal Pah.*

Stems solitary from a creeping rhizome, leaves linear-lanceolate tessellate with pellucid glands, ligule long obtuse hairy, spikelets in bracteate fascicles many empty or gemmiparous, not flattened, fertile few ·75–1″ long; 2–3 lowest glumes neuter, 3–7 fertile, all ovate acute mucronate, many-nerved, puberulous within: palea shorter ovate flattened, keels overlapping, long-ciliate; anther-tips long apiculate or slightly penicillate, ovary subovoid.

Rajmahal Hills, on trap rocks and cultivated by the paharias! (see below).

This bamboo is scarcely distinguishable without fls. from the last; it is said however to be recognised by the scattered culms and to be less hairy and bristly than *B. tulda*. The common wild bamboo (exc. *Dendrocalamus*) of the Rajmahal hills which I have not seen in flower appears to agree better in these respects than with *tulda*, although *nutans* is usually confined to the Himalayan region and Assam. The culms in our plant are 3-4″ diam. with internodes 18″. Stem-sheaths 8-12″ densely covered with black deciduous bristles at back, blade triangular acuminate with rather small fimbriate auricles. L. softly downy (white when dry, beneath with scaberulous margins, ending in a twisted scabrid point, base generally obtuse or subacute, not cordate, rarely rounded but attenuate into the distinct ·12″ long petiole; nerves 8-9 each side of mid-rib.

3. **B. balcooa,** *Roxb.* Balku-bans, Sil-barua, *Beng.*, Boro-bans (Duars).

A large cæspitose bamboo with stems 50–70 ft. high and 3–6″ diam., much clothed with long horizontal leafless stiff branches below, internodes 8–18″ with a whitish ring below and a hairy one above the swollen nodes, walls thick. Stem sheaths of two forms, lower short, broad, ciliate, top rounded; blade short triangular decurrent into short fringed auricles; upper 10–14″ by 8–10″, almost glabrous, ciliate, truncate with blade 6–8″ by 3–4″, closely hairy above, margins recurved, base rounded and decurrent as a narrow band; ligule broad toothed. Leaves oblong-lanceolate with rounded base, 6–12″ by 1–2″, pellucidly tessellate, tip twisted scabrid, margins scabrous ciliate, nerves 7–12 each side. Panicle compound, spikelets ·3–·5″ or more long in dense bracteate heads, ovate-lanceolate, flattened, empty glumes 0–2 ovate acute many-nerved, flg. gls. 4–6 larger, margins ciliate, palea as long as the gl., ovate acute keels long-ciliate, anthers glabrous connective produced, ovary broadly ovoid.

In the plains districts, frequently cultivated. Purneah! Perhaps formerly wild there.

I have not seen the flowers exc. in herbarium, the description being entirely from *Gamble*. Leaf-sheaths appressed-hairy, truncate above with a narrow callus,

bristly or not; ligule broadly triangular, membranous. Rhachis of panicle pubescent or scurfy, swollen above; palea obscurely nerved. Lodicules 3, ovate or obovate, fimbriate. Anthers, glabrous, pointed.

4. **B. vulgaris,** *Schrad.* Sundrogai, *Or.*

A cæspitose bamboo 20–50 ft. high, culms 2–4″ diam., green or often with yellow stripes or quite yellow, nodes hardly raised with usually a ring of brown hairs, internodes 10–18″, walls rather thin. Stem-sheaths 6–10″, often streaked yellow, thickly hairy above, top rounded retuse, blade 2–6″ by 4″, appressed hairy, base decurrent with rounded falcate fimbriate auricles, ligule broad, toothed or fimbriate. Leaves 6–10″ by ·7–1·7″, linear-lanceolate glabrous tessellate with the transverse nervules, sheath laxly hairy, auricle ciliate, ligule short, nerves 6–8 on each side of midrib, marginal very scabrous. Spikelets ·6–·8″ long, oblong-lanceolate, laterally compressed in bracteate clusters or in compact semi-whorls on long interrupted paniculate spikes. Empty glumes 1–2 ovate acute ciliate at tip; flg. gls. larger, 6–10; palea as long, keels white-ciliate; anthers obtuse apiculate or penicillate with short hairs; lodicules 3, winged, ciliate.

Commonly cultivated, but chiefly in gardens! *Gamble* states that it is not native in India.

5. **B. nana,** *Roxb.*

A dwarf shrubby bamboo with culms 6–10 ft. high and ·5–1″ diam., densely cæspitose, green turning yellow, branched from the base, nodes thickened. Stem-sheaths glabrous rounded at top, blade linear acuminate, ciliate. Leaves small linear-lanceolate, 2–4″, not tessellate, auricle of sheath fringed. Spikelets straw-coloured, not compressed, ·5–1·5″, solitary or few clustered on the branches of short diffuse panicles. Gls. 5 or more all flg. or lowest only empty, palea shorter than gl. minutely ciliate on keels near tip only.

Cultivated in gardens only!

6. **B. arundinacea,** *Willd.* Katanga, Katam-madh, *K.*; Kantabans, Ketua, *Beng.*

A very large densely cæspitose bamboo 80–100 ft. high and 6–7″ diam. with numerous horizontal branches below which, as well as many of the other branches, are armed with strong 1–3-nate recurved thorns. Internodes rather short usually about 1 ft. or upper 18″, walls fairly thick and lumen large. Stem-sheaths 12–15″ by 9–12″, top rounded, edges plaited, young densely yellow-hairy, blade triangular, up to 4″, acuminate, concave, felted with dark bristles within, margins decurrent on the sheath wavy densely long-ciliate, hardly auricled. Leaves relatively small, linear or linear-lanceolate glabrous or slightly pubescent beneath, usually about 5–8″ by ·5–·7″, rarely 1″ broad and often very small leaves occur at base of twigs, sheaths pubescent or glabrous. Panicle often occupying the whole plant. Spikelets ·5–1″ long sessile in close dense clusters along the twigs or ·3–·7″ in much laxer clusters (var. *spinosa*); empty glumes 0–2 ovate or ovate-lanceolate acute or mucronate many-nerved, fl. gls. 3–7,

lower 2-sexual upper male with 2–3 uppermost imperfect, keels of palea ciliate, anthers yellow obtuse ·2″ long.

Essentially a bamboo of moist valleys, forming dense gregarious crops in the vicinity of some rivers, often planted in the open. Singbhum, wild along ravines! Very common in some of the Orissa States (*e.g.* Athmallik)! Puri (common in Arang and other forests)! Angul, very common, often covering large areas!

It flowers more or less gregariously but those in the immediate vicinity of streams will sometimes flower some years after the ones in less favourable localities. It flowered and seeded in Puri and Angul from 1896-1899 and again in 1913-1915. In the former case the larger better bamboos in the damper localities are said not to have flowered; it was these however which flowered in the latter period.

There are three separate varieties recorded by *Mr. Gamble*:—

α. **arundinacea** *prover*, rhachis of infl. glabrous hard shining, spikelets few long 6–12-fld., rhachilla evident hirsute, leaves smooth, sheath hairy.

β. **spinosa**, rhachis striate hard not shining, spikelets many shorter 4–6-fld., rhachilla obscure, leaves glabrous above, hairy beneath, sheath hairy then subglabrous.

γ. **orientalis**, rhachis glaucous-green angled almost soft, spkts. membranous 5–8-fld., leaf-sheath hairy with white cilia, petiole hairy.

A Khurda (Puri) specimen collected in 1893 (perhaps one of the first to flower in the 1896 flowering) is named by *Gamble spinosa*, but the rhachilla is very evident with swollen ciliate nodes, the spkts. are few-fld., the leaf sheaths have long bristles and are hairy.

No specimens are to hand of the later flowering in Angul.

The usefulness of this bamboo is marred by the terrible cost of extraction due to the interlacing thorny branches which also render it one of the worst forms of forest to cross after dusk that I know of.

4. OXYTENANTHERA, *Munro.*

Unarmed bamboos, sometimes scandent, with a stout usually creeping and stoloniferous rootstock. Leaves large or small, shortly petioled. Panicle large, branches with few or many heads of whorled or capitate spikelets. Spikelets elongate, cylindric or conical, 1–3-fld.; terminal fl. usually fertile; empty glumes 1–3; fl. gls. elongate, mucronate. Palea of lower fls. 2-keeled, of uppermost convolute, keel 0 or obscure. Lodicules 0. Stamens 6, filaments connate into a short thick at length elongate membranous tube. Ovary ovoid, style slender, stigmas 1–3 more or less plumose. Grain elongate, beaked, smooth.

As in most other of the bamboos the description of the inflorescence has been taken almost verbatim from *Gamble* in the *Flora of British India*, which again is abbreviated from his work in the *Annals of The Calcutta Botanic Gardens*.

1. O. nigrociliata, *Munro.* Bolanji, *Or.*

Stems 30–40 ft. high, ·5–2″ diam., sometimes striped with yellow, internodes scabrous. Stem-sheaths about 6″–10″ long slightly narrowed to the truncate tip, auricles small oval or oblong rounded erect glabrous, when young hairy, blade lanceolate or ovate-lanceolate deciduous on old culms. Leaves 6–12″ by 1–2″, lanceolate, tip subulate often twisted, base unequal and rounded then suddenly narrowed to the short petiole, or more or less cuneate, young pubescent beneath, margins scabro-ciliate towards base or smooth, nerves 9–12 each side of midib; sheath stiff, at first hairy, margins ciliate, auricles rounded naked. Panicle large, compressed. Spikelets 1″, gls. fringed with black or purple cilia, many-nerved, empty gls. 2–3-ovate acute and mucronate, fig. gls. 2–3 perfect and a terminal lanceolate-acuminate

long-mucronate imperfect one ; palea narrow 2–3-nerved between the ciliate keels, anther-tips elongate slender hirsute.

Valleys in the Mals of Puri !

I believe the flowers of the Puri plant have never been collected and the bamboo has been identified by comparison of the vegetative organs only. The description of the fls. is from *Gamble* (from Burmah specs.). The bamboo must have flowered in Puri not many years before my arrival there in 1915 as I found young plants up to 15 ft. high and less. These have leaves 11″ by 2·5″ and are pale beneath but glabrous, the small transverse nervules (described as glands in *F.B.I.*) are very distinct, the sheath has a notch just below the petiole which appears articulate on it, the nerves at the base are somewhat flabellate and the blade at the base hairy above. When young the stem- and leaf-sheaths are dorsally black-strigose. The green oblong or ovate and rounded erect auricles are a very good character for recognising this species.

5. PHRAGMITES, *Trin.* Reed.

Tall stout perennial grasses with long leaves. Spikelets in large decompound panicles, not jointed on pedicel, laterally compressed ; rhachilla jointed at the base above glume iii* and between the other flowering glumes not produced beyond them, elongate between the glumes and with very long silky hairs above gl. iii. Glumes 5–9, glabrous ; i and ii unequal lanceolate, 1–3-nerved, membranous, persistent ; iii much longer narrowly oblong-lanceolate, acute, 3-nerved, male or neuter, persistent* ; iv and other flg. glumes subulate-lanceolate, subaristate, hyaline ; palea much shorter. Lod. obtuse. St. 1–3. Styles 2, terminal, free, stigmas plumose. Grain oblong, terete.

1. **P. karka,** *Trin.* Syn. Arundo karka, *Roxb.* Nal, *H.* ; Jankai, K. ; Narkat, *Vern.*

A very large grass 10–20 ft. high with rather close-jointed hollow stems, often widely spreading by means of long stolons. Leaves stiff erect distichous 1–2 ft. long by 1–1·5″ broad, smaller upwards. Panicles erect lanceolar oblong or oval with branches ultimately widely spreading. Spikelets grey or brown ; gl. i linear-lanceolate ·1″, 1-nerved ; ii ·3″, 3-nerved ; iii ·5–·52″ ; iv as long or longer, other 3–4 flg. glumes successively a little shorter, tip aristiform. Pedicels glabrous.

Along rivers and marshes. Purneah ! Santal Parg. ! Shahabad ! Monghyr ! Gya ! Throughout Chota Nagpur ! No doubt throughout the province. Fl. Sept.–Dec.

The stems are made into shepherds' pipes (*rotu*) and are used for preparing fishtraps (*kumbat*, K.). The tender shoots are greatly appreciated by horses but are laxative.

Triraphis madagascariensis, *Hook. f.* Syn. Neyraudia madagascariensis, *Hook. f.* (in *F.B.I.*).

This is a very large handsome grass, resembling a *Phragmites* in general appearance, which is frequent in sandy nalas in the Tarai and Duars and may perhaps be found in Purneah and the Santal Parganas.

* According to books consulted but I find the rhachilla often articulate above ii and gl. iii readily falling like the other flg. glumes

Stem terete smooth shining 5-6 ft. very leafy. L. attaining 2 ft. by ·3-·5″ ligules fimbriate. Panicles 1-2·5 ft. effuse, with innumerable small spkts. much more graceful than in Phragmites, branches 7-8 nate. Spikelets only ·2″-·3″ long. Glumes 6-7, iii male, awnless, iv and other fl. gls. 3-nerved with long hairs on the submarginal nerves and with a terminal straight or finally recurved awn and 2 minute awnlets on either side. Rhachilla produced between the glumes but only shortly bearded beneath them, and bearing a terminal flowerless glume. Fl. Oct.-Dec.

7. ARUNDO, *L.*

Tall stout perennial grasses with broad flat leaves. Spikelets in large decompound panicles, not jointed on pedicel, laterally compressed; rhacilla glabrous or shortly hairy sometimes bearded between ii and iii, jointed at the base and between the flowering glumes. Glumes 4 or more; i and ii empty, subequal, acute acuminate or aristate, narrow, glabrous, persistent 3-nerved; flg. gls. similar or 2-fid or 2-aristulate at apex either side of the short awn, dorsally hairy all over below the middle; palea hyaline, 2-nerved. Lod. obovate. St. 3. Ovary glabrous, styles distinct, stigmas plumose. Grain oblong.

1. A. donax, *L.*

A tall stout reed-like grass with fistular stems 6–10 ft. high, creeping below. Leaves 1–2 ft. long, by 1–2″ broad, ensiform with amplexicaul base, ligule of long hairs. Panicle 1–2 ft. erect, thyrsiform with scaberulous branches. Spikelets ·3–·5″ long. Gl. i and ii lanceolate as long as spkt. aristo-acuminate (or obtuse and apiculate, *fide F.B.I.*; I have not seen this form from our area where gl. i and ii are almost as much awned as the flg.); flg. gl. 2–4, lateral nerves produced into two slender awn-like teeth each side of the central awn, whole length about that of spkt. or less, palea ·2″ oblong, contracted at base, nerves closely shortly ciliate, rhachilla very shortly produced between the glumes.

Chiefly in the northern area along ditches and streams. Monghyr, *Mokim*! Gya, *Mokim*! Fl. Oct. It no doubt also occurs but has not been collected along our northern boundary.

The rhachilla between gl. i and ii is elongate and minutely pubescent, it is bearded above ii.

8. AVENA, *L.* Oat.

Annual or perennial grasses with usually flat leaves. Spikelets 2–more-flowered, in effuse contracted or spiciform panicles, not articulate on their pedicels; rhachilla jointed at the base (or rather tenacious in cultivated specimens) and sometimes between the flg. gls. Gls. dorsally rounded; i and ii empty, subequal or unequal, thin persistent, few- or many-nerved; flg. gls. ovate to lanceolate, entire 2-toothed or -cleft, 3–7-nerved, lateral nerves sometimes obsolete, lobes awned or not but usually a long and geniculate or reflexed awn with a twisted base dorsal from below the cleft. Palea narrow, keels scabrid or ciliate. Lodicules usually 2-fid. Style short free. Grain various, usually free or in some species (with a villous tip) adherent to the palea.

1. **A. sativa,** *L.* The cultivated oat.

An annual 1–3 ft. high with pendulous spikelets about 1″ long without the ·5–·7″ exserted awn. Gls. very long-acuminate. Bristly hairs at the base of glume iii (in variety *orientalis*). Rhachilla tenacious or disarticulating below gl. iii. Ovary tip villous.

Var. *orientalis* is frequently cultivated in the northern area in the cold season, chiefly by Europeans. Soane Valley, *J.D.H.*!

9. CŒLACHNE, *Br.*

A small leafy variable marsh grass. Leaves short, flat or convolute. Spikelets in open or contracted or spiciform panicles, not articulate on the pedicels, with 2 flowers, upper sometimes imperfect. Rhachilla jointed at the base and elongate between gl. iii and iv. Gl. i suborbicular concave obtuse and delicately nerved: ii smaller, more oblong, both persistent; iii longest, with shortly bearded callus, palea similar, rather coriaceous; iv on the elongated rhachilla, smaller, hairy, palea developed or small. Stamens 3, anthers long narrow. Ovary ovoid, stigmas free. Grain free within the glume and palea.

1. **C. pulchella,** *Br.* Var. spicata, *Hooker f.*

Small, spreading from the root with branches 3–4″ long only or suberect. Leaves flat, ·5–1″ long, erect, linear-lanceolate, with many equal nerves (without midrib), ligule a few hairs. Panicle sub-spiciform with rather flexuous rhachis and very short branches in the sinuses. Spikelets ·08″ long; gl. i suborbicular suddenly contracted to an obtuse tip, very concave, delicately 5-nerved; ii oblong concave 3-nerved, shorter; iii longest, concave ovate, obtuse, nerveless with a large similar palea; iv on the ·02–·03″-long internode of the rhachilla, pubescent, with imperfect flower.

Ranchi, *Clarke*! Fl. Nov.–Dec.

10. ERAGROSTIS, *Beauv.*

Annual, rarely perennial, with erect or geniculately ascending usually slender stems, very rarely prostrate. Leaves narrow. Spikelets in open or contracted panicles, rarely in simple spikes, not articulate at the base (exc. *cynosuroides*), usually strongly laterally compressed; rhachilla firm or articulate, not produced beyond the uppermost glume. Glumes many, sometimes very many, broad (when unfolded), never awned, dorsally rounded or keeled: i and ii equal or unequal, usually separately deciduous, 1-nerved or ii 3-nerved; flg. gls. imbricating, finally deciduous, 3-nerved, 2-sexual or uppermost imperfect; palea broad, membranous, concave towards the rhachilla or margins reduplicate, sometimes persistent on the rhachilla, keels 2. Lod. 2, very minute. Stamens 2 or 3. Ovary glabrous, styles 2. Grain minute, globose, oblong, ovoid or obovoid, free in the glume and palea.

I. Spikelets not secundly spicate, though sometimes in spiciform panicles (Spp. 1–13) :—
  A. Rhachilla of spkts. jointed and breaking up from above downwards :—
    1. Margins of flg. gls. ciliate, panicle spiciform :—
      Spiciform panicle terete. Flg. gls. mucronate or cuspidately acuminate . . . . . 1. *ciliata.*
      Spiciform panicle usually lobed. Flg. gls. muticous 2. *coarctata.*
    2. Margins of flg. gls. eciliate :—
      a. Panicle mostly spiciform, appearing hairy from the long cilia of the palea. Spkts. ·1″ . . *ciliaris* (p. 956).
      b. Panicle open or contracted, not spiciform. Spkts. under ·1″ or if ·1″ palea not long ciliate :—
        i. Leaf-sheaths ciliate at mouth. Panicle not in interrupted whorls, nodes usually ciliate. Keels of palea ciliate or not :—
          Panicle various. Not glandular and odorous . 3. *tenella.*
          Panicle mostly cylindric with short spreading branches glandular and odorous below. Keel of palea rigidly ciliate . . . . . 4. *viscosa.*
        ii. Leaf-sheaths not ciliate at mouth. Panicle not ciliate at nodes, usually elongate, frequently interrupted with branches often fascicled or whorled . . . . . 5. *interrupta.*
  B. Rhachilla of spikelets tough persistent. Flg. gls. falling away from its base upwards, with or without the paleæ :—
    1. Spkts. much compressed, ovate to oblong; side nerves of flg. gls. prominent straight. Paleæ deciduous. Spkts. ·15–·5″ long, pale or pink. Rhachilla straight, closely nodose . . . . 6. *amabilis.*
    2. Spkts. linear or linear-oblong, side nerves less prominent or if side nerves prominent then paleæ persistent. Spkts. often blue-grey or brown. Rhachilla zigzag with distinct internodes :—
      a. Spkts. close, pointing forward, lateral pedicels 0–·2″ :—
        i. Gls. ·06–·08″ acuminate. Grain oblong, striolate .03″ . . . . . 7. *gangetica.*
        ii. Gls. ·04–·06″. Grain broadly ellipsoid or subglobose ·01–·02″ :—
          Spkts. under ·25″ long . . . . . 8. *stenophylla.*
          Spkts. ·25″ long or more . . . . . 9. *elongata.*
      b. Spikelets scattered, spreading or pendulous, pedicels capillary :—
        i. Leaf-margins with small round glands :—
          Gls. ·07–·08″, i 1-3-nerved, ii 3-nerved . . . 10. *major.*
          Gls. ·06″, i and ii 1-nerved . . . . . 11. *minor.*
        ii. Leaf margins eglandular. Gls. i and ii 1-nerved :—
          Spkts. ·25–1″ long linear. Pedicels ·2–·5″. Rhachilla obtusely zigzag . . . . . 12. *tremula.*
          Spkts. ·15–·17″ (elongating to ·2″ after fall of lower gls.). Rhachilla sharply zigzag . . 13. *pilosa.*

II. Spikelets secundly 2-seriately spicate on a simple rhachis or on the branches of an oblong or lanceolate panicle :—
  A. Spkts. sessile and jointed on the branches of a panicle *cynosuroides* (p. 962).
  B. Spikelets secund on a simple spike :—
    1. Leaves convolute, filiform :—
      L. mostly under 6″, uniformly closely puberulous on upper surface . . . . . 14. *coromandelina.*
      L. often 9″ with tufts of or scattered long slender hairs . . . . . 15. *nardoides.*
    2. Leaves linear flat obtuse or subacute, 1–4″ . . 16. *brachyphylla.*

1. E. ciliata, *Nees.*

A grass 1·5–3·5 ft. high with many stems erect or ascending from a tough perennial horizontal rootstock. Leaves short, linear or linear-lanceolate spreading and suberect, 2·5–6″ by ·1–·27″, sheath bearded below the mouth. Panicles densely spiciform, 1·5–3″ long, ·1–·2″ diam. Spikelets ·1–·18″ long, much compressed; gl. i and ii acute ciliate; iii ·08–·09″ long, ending in a mucro or cuspidately-acuminate, keel scaberulous, margins with fine rather long cilia except at the apex; palea about ⅔ths as long, reduplicate keels strong, long-ciliate, also hairy within, tip rounded between the keels; other flowering glumes 5–11 similar, slightly shorter upwards. Grain ·02″ long, terete.

Singbhum, often in the sandy beds of rivers! Hazaribagh, 2000 ft., *Clarke*! Fl. Nov.–Dec. Perennial.

The stems are swollen towards the rootstock and many arise together in the same year. Ligule a few hairs. The rhachilla sometimes terminates in an imperfect glume.

2. E. coarctata, *Stapf.* Tor Chandbol, *S.*

A very closely allied species to *E. ciliata*. The panicle is dense and subspiciform 3–5″ long and ·5″ broad or lobed, or contracted but somewhat laxer and up to 6″ by ·75″, often red. Flowering glumes 5–10, obtuse, ·06″, margins long- or short-ciliate; palea as in *ciliata*.

A very common grass, chiefly in pastures, gardens, etc. Purneah, *Kurz*! Santal Parg., *Nusker*! Gya, *Clarke*! Ranchi, very common! Hazaribagh, *Anders.*, etc.! Udaipur, *Herb. Cal.*! Manbhum, *Clarke*, *Camp.*! Singbhum, very common! Puri, sandy tracts, *Walsh*! Fl., Fr. Sept.–Feb.

Rootstock in our specimens less creeping than in *ciliata*, stems tufted, erect or ascending, 1–3 ft. high, though sometimes flowering when much smaller. Leaves spreading 2–10″ long with long hairs towards the mouth of the sheath, usually flat below and involute finely acuminate upwards. Rhachis of the panicle bearded at the nodes. Old panicles only show the lower glumes of the spkts. which break up from above downwards as in *ciliata*. Grain highly polished, brown, ovoid-oblong, ·02″ long.

E. ciliaris, *Link*, is distributed from the United Provinces to Calcutta, but there appear to be no specimens from our area. Superficially it resembles *ciliata*.

3. E. tenella, *Roem. & Sch.* Bharbhusi, *Vern.*

Usually a small very elegant and slender grass, rarely 18″ high, with many slender tufted stems and slender acuminate leaves attaining 5″ by ·22″, usually much less. Sheaths long-ciliate near the mouth. Panicles decompound excessively branched, branches not whorled with innumerable minute to small spikelets on capillary branchlets and pedicels, usually with long-ciliate nodes, open oval or in some varieties contracted. Spkts. not very strongly compressed, ·05–·17″ long, up to ·04″ broad. Glumes 5–11, ·05″ long or less, oblong, obtuse, convex, lateral nerves about one-third of width of glume (measuring from margin to midrib) from margin which is not ciliate; keels of palea distinctly or obscurely ciliate. Grain broadly ovoid, pale-brown, polished, ·015″ long.

Throughout the province. Often gregarious and (with the next) characteristic of overgrazed heavily trampled areas. The plants are very thickly covered with dew on cold-weather mornings and in the hot weather are dangerous carriers of fire as they often occur on fire-lines and burn like tinder, though from their dwarf nature the line looks well cleared. Fl., Fr. Oct.–Jan. Annual.

Var. *α.* **plumosa,** *Stapf* (*tenella* proper).

Panicle open, branches capillary, nodes bearded. Spkts. long- or short-pedicelled, 3-9-fld., rhachilla subarticulate, gl. i and ii unequal, ii sometimes 1½ times longer; flg. gl. ·03-·04″, anthers very minute.

Behar, *Hope*! Santal Parg., *Nasker*! Gya, *Mokim*! Monghyr, *Kurz*, *Mokim*! Ranchi, *Wood*, etc! Hazaribagh, *Clarke*! Manbhum, *Camp.*, *Clarke*! Puri, *Walsh*. (one specimen 2 ft. high)!

Var. *β.* **riparia,** *Stapf.*

Stems laxer, geniculate at base from a rather elongated rootstock. Panicle contracted, lower ascending branches not more than ·4″ long, subfiliform or capillary, rhachis glabrous. Glumes and grain as in *plumosa*. Sandy tracts, Puri, *Walsh*! Perennial.

Var. *γ.* **breviculmis,** *Stapf.*

Stapf describes this as with stems 1-3″, usually ascending from a prostrate base, panicle 1-1·5″, by ·25-·3″ broad, oblong to ovate-oblong, rather dense but not compact, rhachis bearded or not, empty glumes subequal, flg. gls. ·04″ long, grain ·02″.

Monghyr, near the hot springs, *J.D.H.*! Two specimens are ascribed to it in the *Cal. Herb.*, one from Sant. Parg., the other from Puri. Except for the smaller panicle and habit they resemble *tenella* proper.

4. **E. viscosa,** *Trin.* Syn. E. tenella, var. viscosa, *Stapf.*

Tufted 6–15″ high, the panicles occupying the greater part of the plant. Leaves mostly convolute erecto-patent 1–3″ long with rigid tips, base and mouth of sheath with very long cilia. Panicles dense, cylindric or oblong, 3–5″ long by ·7–1·5″ broad, with very numerous more or less spreading equal sometimes opposite or 2-nate principal branches, but never in interrupted whorls as in *interrupta*, ciliate at the nodes or not, with scattered microscopic glands chiefly on the pedicels and glumes which render the plant viscid and sweet-scented. Spkts. usually about ·12″ long and 7-fld., up to 16-fld., rhachilla readily breaking up. Gl. i and ii subequal ·04″; flg. glumes broadly ellipsoid obtuse or rounded ·05″ with keel minutely scaberulous. Palea nearly as long as glume, rigidly ciliate on the keels. Grain pale-brown polished oval ·02″ long.

Shahabad, *Nash*! Patna, *Ham.*! Ranchi, common! Sambalpur, common! Probably throughout the province. Fl., Fr. Sept.–Dec.

I have kept this distinct chiefly on account of the form of the panicle and the glands which give the plant a distinct smell noticeable as one walks through it, so that it is easily recognisable in the field. Cattle dislike it.

5. **E. interrupta,** *Beauv.*

A variable slender grass from a few inches high to 3 ft., stems often geniculate and ascending from the base, tufted. Leaves slender up to about 9″ by ·2″, often only 2″, glabrous, sheaths not ciliate at the mouth. Panicle very variable, usually stiff, eciliate at the nodes, interrupted with the main branches often pseudo-verticillate. Spikelets ·06–·25″ long, ovate to linear, few to many-flowered. Flg. glumes obtuse, nerves slender, keels of palea scaberulous or smooth, stamens 2, grain obovoid.

There are many varieties:

Var. *α.* **Kœnigii,** *Stapf.*

Panicle long narrow with short dense suberect or erecto-patent pseudo-whorls, spikelets shortly pedicelled usually 6-14-fld., flg. gl. lower ·01″ long; pedicels,

nerves and keel of palea scaberulous in a Behar specimen, usually glabrous or nearly so. Grain ·01″.

Patna, *Ham.*! Gya, *Clarke*! Santal Parg., *Gamble*! Ranchi, *Clarke*! Manbhum, *Clarke*! Puri, *Lace*! Fl., Fr. May-Jan.

Var. β. diplachnoides, *Stapf.*

Stem tall stout branched, panicle long, often over 1 ft. effuse or contracted with solitary or 2-3-nate branches elongate to 1–5″, simple or if branched the whorl rarely overtopped by one or two branches, ultimate branches not divaricate, spkts. 6–12-fld. Rhachis and pedicels often scabrid.

Gya, *Mokim*! Hazaribagh, *Clarke*! Puri, *Walsh*! Fl., Fr. Oct.-Dec.

Var. γ. tenuissima, *Stapf.*

Panicle long loose narrow usually stiff, branches ·5–2″, pseudo-whorled, spreading ramified from the base, branchlets and pedicels divaricate filiform to capillary, spikelets few-fld., fl. glumes very obtuse ·03″ long.

Santal Parg., *Gamble*! Ranchi, *Gamble*, *Clarke*, etc., common! Hazaribagh, on Parasnath, *Clarke*! Palamau, *Gamble*! Fl., Fr. Oct.-Dec.

Var. δ.

Perhaps the same variety as *tenuissima*, but with the more elongate erect branches of *diplachnoides*, spkts. very short with only 3–5 flg. glumes are specimens from Rajmahal Hills, *Kurz*, *Mokim*! and Gya, *Mokim*! These are called *tenuissima* in the *Cal. Herb.*

6. E. amabilis, *Wight & Arn.*

A pretty grass with rather slender stems 6–18″ high. Leaves 1–6″, mostly convolute, sometimes flat, up to ·15″ rarely ·25″ broad, sheaths usually with a few cilia near the mouth. Panicle narrow or ovoid oblong, contracted or effuse, with alternate branches. Spikelets ·15–·65″ long pale or purple, much compressed, ovate or ovate-oblong with 16–70 very close-set imbricating distichously spreading broadly elliptic or ovate (unfolded) glumes ·06–·1″ long, which fall off with their paleas from below upwards; palea ovate as long as glume, keels near margin, scaberulous. Rhachilla tough, very nodose after fall of glume, but straight. Grain ellipsoid or obovoid, somewhat laterally compressed, ·03″.

Common, mostly in wet ground. Purneah! Monghyr, *Mokim*! Santal Parg., *Mokim*, etc.! Ranchi, *Wood*, etc., common! Singbhum, very common! Hazaribagh, *Clarke*! Manbhum, *Camp.*! Orissa, *Walsh*! No doubt throughout the province. Fl., Fr. Oct.–Dec. Annual.

This grass often strongly resembles superficially the English "Quaking Grass." (*Briza*). The lateral nerves of the flg.-glumes are very prominent, their apices do not quite reach the margin. As the spikelets elongate the lower glumes fall away so that the glumiferous portion is usually only ·15–·3″ rarely ·5″ long.

7. E. gangetica, *Steud.* Syn. E. elegantula, *Stapf.* (in *F.B.I.*).

Stems 1–3 ft. high suberect or ascending, slender or rather stout. Leaves erect, flat or subconvolute, up to 6″ by ·17″ nearly glabrous or with a few hairs at base and mouth of sheath. Panicle contracted or with long slender erecto-patent branches which again divide into erect filiform branchlets. Rhachis and pedicels often scabrid. Spikelets ·2–·3″ long (or sometimes after fall of lower gls. elongating to ·5″) on 0–·2″ long pedicels (terminal longer), rhachilla only slightly zigzag but with distinct internodes. Flg. gls. cymbiform somewhat acuminate ·06–·08″ long, sometimes minutely scaberulous or pulverulent.

Anthers ·02–·03″ long. Grain oblong or narrowly ellipsoid, longitudinally striolate, ·03″ long.

Behar, *J.D.H.*, "pratis ubique"! Edge of hot springs, Monghyr, *J.D.H.*! Santal Parg., *Nuskar*! Gya, *Mokim*! Ranchi, *Mokim*! Hazaribagh, *Wood*, also Parasnath ascending to 4200 ft., *Clarke*! Palamau, elev. 2000 ft.! Angul, *Lace*! Fl., Fr. April–Dec. Perennial.

It is very similar to *E. stenophylla* in the character of the panicle and the slatey-blue spikelets, but the longer striolate grain is correlated in all the specimens with the longer usually more acuminate glumes and slightly stouter pedicels than occur in *stenophylla*.

8. **E. stenophylla,** *Hochst.*

Very slender, tufted, erect or geniculate at the base, 6″–2 ft. high. Leaves flat or mostly convolute, attaining 8″ by ·1″, usually hairy at base and mouth of sheath. Panicle 2–8″ long, usually oval and effuse, sometimes contracted when old with very slender or capillary branchlets and close erect or suberect slatey-green or -blue spikelets ·15–·25″ long; pedicels 0–·3″ long (terminal sometimes longer) smooth; rhachilla zigzag with distinct internodes but rather rounded angles. Flg. glumes membranous ovoid or ellipsoid acute, sometimes after falling leaving the rhachilla entirely clothed with the paleas, ·04–·06″ long, back convex, lateral nerves not strong; palea ·03–·05″, marginal keels scabrid. Grain usually broadly ellipsoid and often oblique at the base, rarely sub-globose, shining light-brown, not striolate, ·01–·02″ long.

Very common, usually near the sandy beds of rivers or in nalas, throughout the province. Shahabad, *Levinge*! Monghyr, *Mokim*! Santal Parg., *Kurz, Gamble*, etc.! Ranchi, *Clarke, Wood*! Manbhum, common, *Camp., Clarke*! Hazaribagh, *Clarke*! Singbhum! Puri, several times collected! Fl., Fr. Oct.–Jan. Annual.

Lower leaf sheaths usually loose, ligule of sparse slender hairs.

9. **E. elongata,** *Jacq.*

Stems tufted, variable in height (6–12″ in our specimens) geniculate at base with very narrow flat or convolute leaves bearded at the base and mouth of sheath. Spkts. long ·25–·5″ long usually close-set on short distant spreading branches. Flg. gls. ·07–·09″ long, rather suddenly acute, lateral nerves distinct when dry. Rhachilla rather stout with short internodes, angular. Grain sub-globose ·021–·025″ diam. or broadly ellipsoid ·03–·037″ long.

Manbhum, *Campbell*!

Palea curved nearly as long as glume, suddenly acute or almost apiculate, margins reduplicate minutely ciliolate.

10. **E. major,** *Host.*

Erect or ascending at base 1–2 ft. high, usually branched with flat rather flaccid leaves 3–7″ by ·15–·3″, very acuminate from above the middle, margins with small circular glands. Panicle oblong or ellipsoid, rather stiff, the spikelets (somewhat resembling those of *amabilis*) suberect, rather regularly alternating on the branchlets, oblong, or ovoid-oblong, ·2–·3″ long, by about ·1″ broad at base, on pedicels mostly under ·1″ long. Gls. i 1–3-nerved, ii 3-nerved, ovate; flg. gls. rather large, ·07–·08″ long, broadly ovate and concave, scarcely keeled though midrib strong, scarcely reaching the rounded

tip, side-nerves strong. Paleæ remarkably persistent, often clothing the whole rhachilla after fall of the glumes and sometimes semi-amplexicaul with their reduplicate margins, broadly obovate, much curved with scabrid or ciliolate keels. Grain brown, quite globose, slightly striolate, ·02″ diam.

Bhagalpur, *Cal. Herb.*! Monghyr, *Mokim*! Gya, *Clarke*, etc.! Ranchi, *Wood* (from garden)! Fl., Fr. May–Dec. Annual.

L. with sheath sparingly bearded. Panicle mostly effuse, branches solitary or nearly so, pedicels scabrid. Spikelets grey. An easily recognised species.

11. **E. minor,** *Host.*

A much more delicate plant than *E. major*, which it closely resembles except in smaller dimensions. Stems 6–18″, slender. Leaves 2–5″ long by ·2″ or less sometimes incurved (probably pressed after wilting), finely acuminate, margin with small disciform glands as in *major*. Panicle ovate or oblong, branches solitary capillary, branched from near the base. Spikelets ·12–·3″ long on slender mostly short pedicels, up to 12-fld. Gls. ·06″ long or slightly less upwards, broadly ovate rounded as in *major*, midrib reaches margin. Grain not quite so globose as in *major*, but similarly microscopically striolate and ·02–·022″ long.

Behar (probably Shahabad), *Levinge*! Purneah (near, at Maldah), *Clarke*! Santal Parganas, *Mokim*! Monghyr, *Mokim*! Fl., Fr. April–Oct. Annual.

I would call this a form of *E. major*, though it is supposed to differ by gls. i and ii being both 1-nerved. Mouth of leaf-sheath slightly bearded.

12. **E. tremula,** *Hochst.*

A slender grass with tufted stems 1–2 ft. high with large very effuse and lax ovoid panicles somewhat resembling *amabilis* but spikelets much narrower (linear) and longer, ·25–1″ long on capillary solitary pedicels, axils of panicle-branches with long cilia. Paleas persistent.

Frequent, in dry sandy places. Shahabad, *Levinge*! Gya, *Mokim*! Ranchi, *Clarke*, etc! Hazaribagh, *Prain* (Damodar River), *Clarke* (Parasnath)! Singbhum! Puri, *Walsh*! Sambalpur! Fl., Fr. Aug.–Nov. Annual.

Leaves up to about 9″, suberect, usually convolute, sometimes flat and ·15″ broad, base of blade and mouth of sheaths villous. Panicle-branches all solitary, filiform. Spikelets 10-70-flowered. Flg. gls. ·06–·07″, closely imbricate, broadly ovate (when unfolded), subobtuse. Rhachilla zigzag with rounded corners (flexuous), bearing the sub-permanent paleas after fall of the glumes, internodes thickened upwards. Palea a little shorter than glume, keels scabrid. Grain globose pale ·02″.

13. **E. pilosa,** *Beauv.*

Very slender with mostly simple stems (clustered at base) 3″–3 ft. high. Leaves attaining 4″, rarely over ·1″ at base, tapering from base to apex, base and mouth of sheaths with cilia up to ·15″ long. Panicles open, rarely contracted, usually exceedingly delicate with very capillary branches and slender spikelets, at other times rather stouter. Branches of panicle in rather distant pseudo-whorls, usually with long cilia at their axils. Spikelets mostly purple or grey, ·15–·17″ or over ·2″ after fall of some of the glumes. Glumes laxly arranged on the slender sharply zigzag rhachilla, the angles of the zigzag nodose with the minute bases of the glumes and flowers.

Flg. gls. ·04–·05″ long, ovate (when unfolded) subacute, very thin, lateral nerves weak. Palea with recurved sides, nearly as long, some sub-persistent, others quickly falling, keels sparsely scaberulous. Grain ·02–·03″ long, oblong with one side straighter than the other and sometimes with a small apiculus at base of it, brown.

Mostly in sandy ground. Gya, *Clarke*, etc.! Monghyr, *Mokim*! Hazaribagh, *Clarke*! Singbhum! Manbhum, *Camp.*, *Clarke*! Ranchi, *Wood*! Orissa, *Walsh* (probably Puri)! Fl., Fr. Aug.–Jan. Annual.

Gl. i is very minute, nerveless and hardly ·01″ long.

14. E. coromandelina, *Trin.* Syn. Poa coromandelina, *Koen.*

A tufted erect wiry grass 12–20″ high with a number of dry leaf-sheaths at the base of stem. Leaves 1–4″ filiform, convolute, puberulous all over the inner surface, radical often recurved, cauline erect or slightly curved. Spikelets grey ·2–·35″, rarely·5″ long, on one side of the rhachis but suberect and inclined alternately to either side, close set or over their own length apart below. Gl. i oblong-lanc. 1-nerved with scaberulous keel, ·08″ long; ii subequal but broader and more obtusely keeled; flg. gls. ·09″, ovate, somewhat tapering upwards to an obtuse or acute tip, lateral nerves very weak; palea ·06″, reduplicate or concave towards rhachilla, keels slender, not quite marginal, minutely ciliolate. Grain broadly ellipsoid ·025–·03″ long, minutely striolate, sometimes obtusely 3-gonous.

Dry pastures and rocky places. Purneah, *Kurz*! Santal Parg., *Nuskor*! Ranchi (Damuda ghats)! Hazaribagh, *Prain*! Manbhum, common, *Camp.*! Fl., Fr. Sept.–Dec. Perennial.

According to *F.B.I.* the rhachis of spike is slender terete and smooth, but it is angled and grooved on the side of the spikelets and sometimes scaberulous. The grain is described as shortly ellipsoid or subovoid, obtusely 3-quetrous, with epicarp loosely reticulate.

Var. or **nardoides** ?

Four sheets from Gya and Hazaribagh (near Parasnath, 1000-3000 ft. elev.) are called *nardoides* in *Herb. Cal.* They appear only to differ in the longer leaves (attaining 8″), but they are all puberulous on upper (inner) surface.

15. E. nardoides, *Trin.*

A densely tufted grass with long erect filiform leaves 6–9″ with very delicate long scattered or grouped hairs which project from between the involute margins chiefly below the middle, also sometimes minutely puberulous above. Spike long slender 6–10″ with a smooth terete rhachis and many close-set erecto-patent spikelets ·3–·5″ long by ·06″ wide at base. Flg. gls. turgid, ·07″ long; gls. i and ii subequal, acutely keeled. Grain ellipsoid-oblong with oblique base, striolate.

Gya, *Mokim*! Hazaribagh, *Clarke*! also on Parasnath, *Clarke*! (*Kew Herb.*). These are not the same sheets as are doubtfully referred to under *coromandelina*. It is possible that the long hairs are deciduous.

16. E. brachyphylla, *Stapf.*

Erect 10–18″ high from a tuft of old fibrous leaf-sheaths and short linear flat or conduplicate leaves 2–4″ long by ·08–·1″ wide, obtuse or subacute. Spikelets ·2–·75″ long, close-set, linear or linear-oblong, secund, 2-seriate, lenticular in section, in long simple terminal spikes 3–8″ long. Glumes closely imbricate, i and ii ·05–·06″ long, sub-

equal; flg. gl. ·08–·1″ long, rather turgidly broadly ovate (when unfolded) with rounded tip or obtuse, lateral nerves very weak, midrib microscopically scabrid; palea as large, somewhat obovate, concave towards rhachilla, keels scabrid. Grain ·02–·025″, shortly ellipsoid, obscurely 3-gonous, reticulate.

Monghyr, *Ham.*! Singbhum, on high ground! Fl. Aug.-Sept. Perennial. Leaves nearly all radical.

11. DESMOSTACHYA, *Stapf.*

Spikelets much compressed, imbricate, secund sessile and *articulate* on the very short densely crowded branchlets of a tall narrow racemiform panicle, acute and deciduous; rhachilla subarticulate.

Other characters of *Eragrostis.*

1. **D. cynosuroides,** *Stapf.* Syn. Eragrostis cynosuroides, *Beauv.*

Rather stout 1–3 ft. high from a vertical deeply subterranean rootstock. Leaves up to 18″ and ·2″ wide, tips setaceous, margins minutely scabrid, mouth of sheath with or without long hairs. Panicle strict racemiform, linear or oblong 3–12″ long by ·25–1·25″ broad, grey-green bearing densely secundly arranged spikelets ·25–·3″ rarely ·5″ long in 2 series along the 1–3-nate short branches of which the lower are about ·7–1″ long or less, or spikelets borne direct on the main rhachis above. Glumes 15–30; ii twice as large as i; flg. gl. ·6–·07″ long, ovate obtuse or apiculate when unfolded, lateral nerves reaching about half way to margin.

In open grass lands. Behar, *Hope*! Shahabad, *Levinge*! Gya, *Mokim*! Monghyr, *Mokim*! Santal Parg., *Nusker*! Ranchi and Palamau, near Neterhat, elev. 2000 ft.! Fl., Fr. June–Nov. Perennial.

Panicle sometimes interrupted at base and narrowly pyramidal, branchlets glabrous or hispidulous. Flg. gl. rather coriaceous, keels scaberulous. Palea nearly as long, reduplicate, keels microscopically scabrid. Grain obliquely ovoid, obscurely trigonous. Rhachilla easily disarticulate.

12. DIPLACHNE, *Beauv.*

Tall perennial grasses with narrow flat or convolute leaves. Spikelets many-fld. spicate on the slender simple branches of a tall simple panicle; rhachilla jointed at the base and beneath each fl. gl., not produced beyond the uppermost glume. Glumes many, i and ii unequal, obtuse, membranous, 1-nerved, persistent; flg. gls. rather longer, oblong, 1–3-nerved, tip 2–4-toothed, mucronate or awned; palea linear. Lod. broad. Stamens 3 with short anthers. Styles distinct. Grain ovoid-oblong, subtrigonous, free within the gls. and palea.

1. **D. fusca,** *Beauv.*

A tall grass 3–5 ft. with long narrow smooth leaves and large membranous lacerate ligule. The panicles are 6–18″ long with long erect, finally nodding, branches. Spkts. ·3–·4″ long, linear, 4–10-fld., very shortly pedicelled. Gls. i and ii with erose tips and nearly smooth keels; flg. gls. ·12″ long, 4-toothed at tip and aristulate by the excurrent midrib, lateral nerves inconspicuous submarginal.

In swamps. It has a wide distribution and occurs all round our area, near Purneah and the north-west provinces, Calcutta and the peninsula; it will probably therefore be found inside the province.

13. ELYTROPHORUS, *Beauv.*

An annual erect grass with narrow flat leaves. Spikelets very minute in globose or ovoid sessile clusters densely or interruptedly packed along a central rhachis and forming a long more or less cylindrical often lobed or interrupted spiciform panicle; each cluster consists of very many densely crowded sessile compressed spikelets with awned glumes subtended by many empty glumes, not jointed at the base; rhachilla jointed at the base and between the flg. glumes. Glumes of perfect spkts. 5–7; i and ii subequal empty membranous, mucronate, keeled, 1-nerved, persistent; flg. gls. rather larger, narrowed into short awns, 3-nerved, uppermost empty; palea complicate, one or both keels winged. Lod. 2, obliquely oblong. Anthers 1–3 minute. Styles free, stigmas long hairy. Grain obliquely oblong, beaked free.

1. **E. articulatus,** *Beauv.*

A tufted erect usually small grass 6–10″ high, sometimes up to 18″. Leaves ·5″ to as long as the plant, up to ·1″ wide. Spiciform panicle often flowering to the base, cylindric ·2–·4″ wide or lobed with the more unequal and oblong clusters, bright-green. Fl. glumes strongly 3-nerved with the scaberulous awn about as long as the ·06–·07″ long blade, palea ·04–·05″ long and with the wings nearly as broad above, wings sometimes lacerate.

Rice-fields, common. Purneah! Ranchi, *Prain*, *Gamble*! Singbhum! Manbhum, *Camp.* Fl., Fr. Nov.–Dec.

14. TRITICUM, *L.*

Annual or perennial grasses with flat leaves. Spikelets sessile tumid, distichously spicate with their sides opposite recesses in the articulate or inarticulate rhachis, solitary in the cavities. Glumes few, rigid, often unequal-sided; i and ii empty, obtuse or shortly awned, few-nerved, persistent; flg. gls. oblong or ventricose, dorsally rounded or keeled above, awnless or 1–3-awned, 5–9-nerved, lateral nerves not conniving with the central; upper fl. male or neuter; palea with ciliate keels. Lod. entire, ciliate. St. 3. Styles very short. Grain grooved ventrally, often hairy, free or adhering to the palea.

1. **T. sativum,** *Lamk.* Syn. T. vulgare, *Villars*; Gehun, giun, *H.*; Gom, *Beng.* Wheat.

Wheat is commonly grown in the province, but mainly in the Northern area along the Gangetic plain, especially Patna, Shahabad, Monghyr and Bhagulpur. Very little is grown in the Central area and hardly any in the Southern, the last chiefly an inferior red grain.

15. HORDEUM, *L.*

Erect annual, rarely perennial grasses with flat leaves. Spikelets sessile in 2–more rows spicate in the recesses or at the nodes of a simple

inarticulate rhachis, 2–3-nate with the plane of the spkts. tangential to the rhachis, the lateral often imperfect, rhachilla jointed at the base of the flg. gl. and produced above it with sometimes an imperfect glume. Glumes 3, i and ii empty very narrow, rigid, persistent, the outer of each cluster of spkts. together often resembling an involucre; iii 2-sexual dorsally rounded, 5-nerved above, narrowed into an erect or recurved awn; palea 2-keeled. Lod. ciliate. Stamens 3. Styles very short. Grain grooved in front, tip usually villous, adherent to the palea or not.

1. H. vulgare, *L.* Jau, *Vern.* Barley.

Barley is very little grown in the province. Small crops are found in the Gangetic plain and also in Chota Nagpur. Soane Valley, *J.D.H.*!

Hooker's specimen is var. *hexastichon* with spikelets in 6 ranks. L. scabrellous on nerves. Spkts. ·4–·5″ long to base of the long awn, fertile smooth or nearly so, abortive spkts. pubescent ending in filiform awns. Awn of fertile spkts. projecting some 4–5″ beyond the ear, very stout, flattened and spinulosely scabrid.

16. OROPETIUM, *Trin.*

A very small cæspitose grass with filiform leaves and very minute distichous spikelets half immersed in the alternating cavities of the rhachis of a simple slender curved inarticulate spike; rhachilla bearded, articulate at the base. Glumes 3, i and ii empty, persistent; i very minute, hyaline appressed to rhachis; ii linear-lanceolate, rigid, recurved in fruit, tip obtuse or emarginate; iii shorter, broader, hyaline, obtuse or truncate, 1-nerved; palea narrow, keels smooth. St. 3. Styles short. Grain oblong, terete, free.

1. O. Thomæum, *Trin.*

A curious little grass, the whole plant only 2–3″ high forming dense hard tufts with filiform leaves ·5–·75″ long, ciliate with long hairs, ligule lacerate. Spikes ·75–1·5″ long, solitary, or fascicled on very short branches, slightly curved with a flexuous flattened rhachis, the spikelets in the undulations of the narrower sides; gl. i very minute; ii ·05″ long, slightly recurved and convex; iii very thin, curved inward, ·04″ long slightly exceeding the small oblong grain.

On old walls. Gya! Monghyr, *Mokim*! Fl., Fr. Sept.–Oct.

17. MICROCHLOA, *Br.*

Slender perennial grasses with filiform convolute leaves. Spikelets very narrow, minute, 2-seriate and unilateral on a solitary terminal filiform somewhat curved spike, not jointed at the base; rhachilla jointed at base not produced beyond gl. iii. Gl. 3, i and ii empty, membranous, 1-nerved, keeled persistent,; iii very small, oblong, hyaline, palea as long, with ciliate keels. Lod. truncate. Anthers linear. Styles distinct. Grain oblong fusiform, glabrous, free within the hyaline glumes.

1. M. setacea, *Br.*

A very small grass only 3–6″ in our specimens (6–10″, *J. D. H.*) with tufted very slender stems and filiform leaves ·3–·75″ long, glabrous

striate and with about 3 fine raised nerves, blades often curved. Spike 1–4″ long very slender, rhachis flattened with rounded back. Spikelets ·07–·08″ long erect, close-set. Gl. i and ii subequal, as long as spkt. with a very narrow opaque center looking like a double nerve and hyaline margins, linear-lanc., acute; iii on very minute rhachilla, about three-fourths to four-fifths as long as i and its palea villous (nerveless, *F.B.I.*, but both it and its palea appear to me 2-nerved).

Gya, *Mokim*! It usually grows on old walls according to *Roxburgh*.

18. GRACILEA, *Koen.*

Small grasses with short leaves. Spikelets in deciduous clusters which are secund and jointed on the filiform flexuous rhachis. Upper spikelets in the cluster sometimes imperfect. Rhachilla not jointed at the base, sometimes produced between the glumes and beyond the last imperfect glume and bearing empty glumes. Glumes 4–6 altogether, i narrow rigid long-ciliate, produced into a long rigid scabrid awn; ii broader with broad hyaline margins, ciliate, awned; iii broadly ovate or -oblong, membranous, 3-nerved, 1–3-awned or 3-cuspidate, usually 2-sexual, palea nearly as broad, 2-cuspidate; iv smaller, usually male. Lod. cuneiform. Anthers small. Grain oblong, free.

1. **G. Royleana,** *Hook f.*

A pretty little grass 3–8″ high, with filiform leaves ·5–1″ long more or less convolute often sparsely ciliate, sheaths rather loose, with scattered long hairs with minute tubercle-bases. Clusters ·15–·3″ long (exc. the awns), 1–6 rather remote on the flexuous rhachis. Gl. i (with its awn) ·3″ long, densely ciliate on to the awn; iii elliptic-oblong, 3-cuspidate or 1-awned and 2-cuspidate, ·2″ long with the cusps, palea narrower, 2-cuspidate, as long; iv on a short extension of the rhachilla, and its palea ·1″ long, both shortly awned. Rhachilla produced above iv for ·05–·06″ and bearing 2 short empty awnless glumes. Grain ·06″ long.

Behar, *Hope*! Gya, *Nusker*! Fl. Oct. Annual.

19. TRIPOGON, *Roth.*

Slender densely tufted grasses with usually convolute leaves. Spikelets 2-seriate and unilateral on a very slender terminal spike, not jointed at the base, bearing several flowering glumes and 1–2 terminal imperfect; rhachilla produced between the glumes and jointed at the base and below each glume. Gl. i and ii unequal, 1-nerved, empty, persistent, i usually appressed to the rhachis or lodged in a furrow in the rhachis, often toothed or lobed on one side; ii entire or notched below the mucronate or subaristulate tip; iii and other flowering glumes dorsally convex, 2-fid and awned from the keel or 4-fid with the outer lobes awned, the inner membranous and rarely awned; palea complicate. Lod. 2. St. 2–3. Styles very short. Grain narrow, free.

1. T. capillatus, *Jaub. & Spach.*

A densely tufted wiry grass 8–10″ rarely 20″ high with filiform leaves 4–10″ long. Spike 4–12″ long filiform, flexuous. Spikelets alternate distichous greater than their length apart with 2–4 flowering glumes. Gl. i ·1″ long acuminate; ii ·2″ long, subaristate; rhachilla ·04–·05″ long between the fl. glumes which are bearded at their base, lanceolate, 3-nerved, 2-fid, ·2″ long with keel produced into a slender awn ·3–·6″ long; palea lanceolate, 2-nerved, ·1″ long. Grain narrowly terete, brown, ·05–·07″ long. Rhachilla ending in 2 small imperfect glumes.

On stems of trees or rocks. Parasnath, *Clarke, Kurz!* Fl., Fr. Sept.-Oct.

Stem at base clothed with leaf-sheaths. L. usually only 4-6″ by about ·12″, involute when dry. Spkts. ·2″ long. Gl. i ·15–·17″. Awns of flg. gls. ·3–·5″ or more.

2. T. Jacquemontii, *Stapf.*

This may be found in our area as it occurs in Central India, Deccan, Madras, and there is one specimen of *Griffith's* from Bengal, district unknown. On rocks. Fl. Oct.

A tufted grass with slender stems 1-2 ft. high and longer leaves than the last. Spkts. large up to ·8″ long, but awns shorter than their glumes which are about ·1″.

20. CYNODON, *Pers.*

Perennial, creeping or ascending, with narrow flat leaves. Spikelets minute, unilateral and 1-2–seriate on slender digitate spikes, not jointed at the base; rhachilla jointed at the base, sometimes produced beyond gl. iii.* Glumes 3, i and ii empty, thin, keeled, persistent or separately deciduous; iii broader (and larger in our species), membranous, awnless; palea as long, 2-nerved. Lod. short. Anthers large. Styles distinct. Grain oblong, free within the glumes.

1. C. dactylon, *Pers.* Syn. Chloris Cynodon, *Trin*†; Panicum dactylon, *L.*; Dub, *H.*; Dubi, Dhobi-ghas, *K.*, *S.*

A rather variable creeping or ascending grass with stems widely spreading and frequently matted, at other times very slender and ascending among other grasses. Leaves on the prostrate stems usually very short, spreading, subulate, glaucous, ·5–1·5″, on the ascending stems up to 3″ by ·08–·2″, linear or lanceolate-acuminate; ligule hardly any or of hairs. Spikes 2–8, ·5–3·5″ long (see var.), rhachis flattened, sometimes slightly winged. Spikelets very close, ·08″ rarely ·09″ long; gl. i ·06″ long, narrow, conduplicate acute; ii ·03–·04″, similar; iii largest very broadly cymbiform with softly ciliate keel sometimes making the glume mucronulate, palea much narrower, strongly 2-nerved. Rhachilla sometimes produced to half

* The *Flora British India* says that the rhachilla is not produced, or, if produced, then at the back of gl. iii only. I have, however, several times found it not only produced but bearing a minute rudimentary glume, so that I had named a specimen I sent to *Cal. Herb.* in 1889 *Chloris sp.* There it was correctly matched with *Cynodon dactylon*. The rhachilla is not at the back of gl. iii but in the normal position.

† In view of the frequent presence of a rhachilla produced beyond gl. iii, the absence of an awn is the only character separating this and *Chloris*, but the upper glumes of *Chloris* are usually better developed.

the length of gl. iii and bearing a minute rudimentary glume. Grain brown, oblong or fusiform-oblong, ·04–·05″ long.

On sandy soil throughout the province, but only on damp ground in the dryer districts! Fl., Fr. most of the year according to locality.

One of the best fodders, perhaps the best for horses, but rather difficult to collect, and it requires beating and winnowing to get rid of the dirt.

It extends into Europe and is the English *Dog's Tooth* grass, the German *Hundszahn* and the American *Bermuda Grass*. A preparation is applied by the Santals in a parasitic disease which attacks the spaces between the toes. *Campbell. Nadkarni* states that the fresh expressed juice of the grass is astringent. It is also used in India (as on the Continent, where it is officinal) as a diuretic and urinary sedative in cystitis and other diseases.

Var. **suberectum.**

A stout very nearly erect tufted form 10–15″ high with long stolons. Leaves 2–3″ long, by ·15–·22″ broad, acuminate, rather strongly 3-nerved each side of midrib. Spikes 5–8, 2–3·5″ long. Spkts. ·09″ long, 1-seriate, imbricate.

Singbhum! Rajmahal Hills, *Kurz*!

21. CHLORIS, *Sw.*

Perennial rarely annual, with usually flat leaves. Spikelets 2-seriate closely unilaterally arranged on solitary fascicled or shortly spicate spikes at the top of the stems, sometimes minutely pedicelled, not jointed at the base: rhachilla jointed at the base and usually produced beyond gl. iii and bearing 1 or more empty glumes. Gl. i, narrow, 1-nerved, keeled, acute, usually posterior: ii larger, often shortly awned: iii 1–3-nerved, acute, obtuse or 2-toothed, usually awned; palea rather shorter, 2-nerved, complicate. Lod. 2. Anthers small. Styles free. Grain narrow, free, often with loose pericarp.

A. Rhachilla not at all produced beyond gl. iii:—
  Awn of iii ·7–1″ long . . . . . 1. *pallida*.
B. Rhachilla produced beyond gl. iii:—
  1. Gl. at the end of rhachilla reduced to simple awns (or gl. very minute, flat in *incompleta*):—
    Annual, simple. Spikes 1·5–2·5″. Awns on rhachilla 2–3 . 2. *delicatula*.
    Perennial, tufted. Spikes 4–7·5″. Awn on rhachilla 1 . . 3. *incompleta*.
  2. Rhachilla bearing 1–2 awned tubular or inflated glumes:—
    Gl. ii shortly awned. Barren gl. i, semi-tubular . . . 4. *virgata*
    Gl. ii awnless. Barren gl. ii, subglobose . . . . . 5. *barbata*.
  3. Rhachilla bearing 3–4 barren glumes. Spkts. 4-awned altogether . . . . . 6. *montana*.

1. C. pallida, *Hook. f.*

A slender tufted grass 10–18″ high with erect very narrow linear leaves 4–8″ long by ·08–·1″ broad, sparsely hairy inside towards the base and ligule of a few hairs, tip filiform. Spikes 1–3 erect digitate 3–5″ long by ·15–·2″ broad, yellow, closely pectinate with the two rows of erecto-patent long-awned spikelets. Spikelets narrow tapering, about ·1–·12″ long without the awns: gl. i ·15–·17″ including the short awn, lanceolate: ii ·13″ also with a short awn, both thinly hairy on keels; iii silky and with bearded base, ·08″ without the long ·7–1″ awn, tip minutely notched: palea much narrower, ciliate on keel. Grain linear ·05″, including the pericarp which is produced beyond the seed.

There is no production of the rhachilla beyond gl. iii and no rudimentary glume iv.

Hazaribagh, *Anders.*! Manbhum, *Camp.*! Fl. Sept. Annual.

2. **C. delicatula,** *Clarke.*

A very slender erect grass 4–12″ high, stems simple or with 1–2 erect branches from near the base. Leaves short spreading, concave or convolute, ·3–1″ long, none from the root at the time of flowering. Spikes 5–10, very slender, erect, 1·5–2·5″ long, closely spicate at the top of the stem. Rhachis capillary scabrid with light-coloured center. Spikelets ·1″ including the subaristate tip of gl. ii; i turned towards the rhachis ·08″ long very slender acuminate, not awned; iii ·06″ long, delicately hairy on back, tip 2-lobed, awn very fine ·3″ long: palea very narrow, glabrous. Rhachilla produced beyond base of iii to half its length or rather more, and bearing at its tip 2, rarely 3, very fine awns nearly as long as the awn of iii.

Hazaribagh, *Clarke* (the type). Manbhum, common on high lands, *Camp.*! Fl. Oct. Annual.

3. **C. incompleta,** *Roth.*

A tufted grass 2–4 ft. high. Stems clothed at base with old leaf-sheaths, glabrous. Leaves linear up to 15″ long by ·45″ wide, flat, glaucous scaberulous, often also shortly pilose towards base; ligule of long hairs. Spikes 4–10 digitate, often widely spreading, 4–7·5″ long, ·06″ broad (without the awns). Spikelets 2-seriate minutely pedicelled, the pedicel decurrent on rhachis. Gl. i one-fourth to half ii, very narrow with subaristate tip; ii ·2″, including the short awn, sometimes much shorter, notched at the tip; iii with the rhachilla bearded at its base, equals ii, dorsally flattened, lanceolate, with incurved margins, minutely 2-toothed at tip, awn ·25–·4″ long. Rhachilla produced above base of gl. iii and bearing a minute glume and an awn ·2″ long.

Karakpur Hills, Monghyr, *Kurz*! Hazaribagh, *Clarke*! Damp places in the forest, where it attains its greatest development, *Palamau*! Puri, *Walsh*! Fl. Oct.–Nov. Perennial.

Sheaths often very hairy. The spikelets in our specimens are mostly nearly ·2″, but *Hooker* states that they are found as small as ·12″. The rhachilla is produced to about half the length of gl. iii.

4. **C. virgata,** *Sw.*

A tufted leafy grass 1–2 ft. high, decumbent and often proliferously branched below. Leaves often reaching top of stem, up to ·15″ broad, sparsely ciliate; sheaths rather loose and keeled; ligule of hairs. Spikes 6–15, erect, crowded at the end of the peduncle, 2–2·5″ long, rhachis minutely hairy. Spikelets ·1–·13″ excluding the awns, 3-awned including that of II (2-awned, *J. D. H.*). Gl. i slender subulate, about half ii; ii ·1″ or with the delicate awn ·15–·17″ (always more or less awned); iii cymbiform and rather deep, or when unfolded ovate, ·1–·12″ long, base shortly bearded, tip acute or 2-toothed and ciliate with long erect hairs below the tip sometimes extending to the middle and sometimes with a few cilia below, keel produced into an awn ·4″ long; palea much narrower and rather shorter, often

reduplicate, toothed or notched. Rhachilla somewhat adnate to iii, shortly produced, ·03–·04″ long, bearing a curious semitubular or bucciniform truncate glume ·06″ long with 2 minute auricles at tip and an awn ·3″ long. Grain fusiform, sometimes slightly curved, ·06–·07″ long, pericarp loose.

Frequent. Sometimes on old brick walls. Santal Parg., *Kurz*, etc.! Monghyr, *Mokim*! Gya, *Mokim*! Ranchi, *Wood*! Fl., Fr. Sept.–Nov. Annual.

I doubt the specific value of the number of upper empty glumes. Some specimens of *virgata* at Kew have 2 empty glumes.

5. C. barbata, *Sw.*

Rather a robust species ascending 1–3 ft. high from a usually very geniculate much proliferously branched base. Leaves long, 6–15″ by ·12″ smooth or scaberulous, hairy at base and at top of sheath or not, ligule very narrow. Spikes crowded 6–20 erect at the top of the stem, 1–3·5″ long, easily recognised from the balloon-like appearance of the barren glumes, rhachis scaberulous. Spikelets minutely pedicelled; gl. i about ·05″; ii not awned, ·08″; iii obovate and rounded when opened out, ·1″ long, very ciliate above the middle, awn ·2″; palea broadly lanceolate or obovate; rhachilla adnate then free, short, bearing 2 curiously inflated or very concave obcuneate or obovate (when opened out) truncate glumes, lower ·03″ with awn about ·15–·17″, upper shorter subglobose with shorter awn.

Purneah, *T. Anders.*! Santal Parganas, *Mokim.*! Puri, *King, Walsh*! Fl. Oct.–Nov. Perennial.

6. C. montana, *Roxb.*

This is recorded in *Bengal Plants* as from Western Behar, apparently on account of its general distribution, as no specimens from that region appear to be either at Kew or Calcutta, but there are some from the Upper Gangetic Plain.

The spikes are 2–6 only, rhachis glabrous. Gl. i and ii both finely acuminate or ii shortly awned; iii ovoid acute, ·09–·1″ long, upper margins more or less thickly bearded as in *virgata*, awned; iv much smaller cuneate, conduplicate and embracing v and vi, awned from the truncate tip; v cuneate or subglobose, small and enclosing the still smaller or minute gl. vi, both awned. Rhachilla jointed at base only.

22. ELEUSINE, *Gaertn.*

Annual or perennial, leaves usually flat. Spikelets often crowded, closely 2–3-seriate and unilateral or secund on digitate capitate or subverticillate spikes, laterally compressed with their sides to the rhachis, not jointed at the base, rhachilla with internodes between the flg. glumes, not jointed. Glumes few or many, keeled; i and ii shorter than the flowering, persistent, subequal or unequal, i lanceolate, ii lanceolate, acute or acuminate or awned, or very broadly ovate, or didymous with a short stout recurved awn; flg. glumes several (uppermost often smaller and imperfect), like the empty, 3-nerved or sometimes obscurely 5–7-nerved; palea complicate or reduplicate, keels strong. Lod. 2, cuneate. Anthers 3, short. Style short, distinct. Grain free, oblong or globose, pericarp hyaline, loose, seed rugose or smooth.

A. Glumes not awned. Spkts. mostly pointing forward:—
Spikes slender, nearly glabrous at base. Seed oblong obtusely 3-gonous . . . . . 1. *indica*.
Spikes stout, often incurved, pubescent at base, seed globose . 2. *coracana*.
B. Glumes awned. Spkts. at right angles to rhachis. Seed subglobose, very rugose . . . . . 3. *ægyptiaca*.

1. **E. indica,** *Gaertn.* Nandia, *Or.*; Kodai, *M.*; Bir kode, *K.*; Malankuri, *H.* (f. *Roxb.*).

A rather robust tufted annual 1–3 ft. high with loose sheaths and usually flat leaf-blades 3–12″ long and up to ·25″ wide. Spikes 3–7 erect or spreading at the top of the stem with sometimes a subsidiary lower whorl, 2–5″ long, the spikelets mostly pointing forwards (empty gl. i and ii often spreading after fall of the fruit). Spikelets up to ·25″ long, usually much smaller, 3–5-flowered. Gl. i about ·07″, 1-nerved; ii 3-nerved close to the keel, sometimes apiculate, not awned; iii–v (rarely more) ·12″, but decreasing somewhat in size upwards, cymbiform, obtuse, subobtuse or apiculate, nerves all in the keel, margins broad hyaline; palea shorter 2-nerved, reduplicate or margins reflexed. Grain ·05–·06″ long, seed chestnut, oblong and obtusely 3-gonous with oblique base, transversely rugose, sometimes obscurely, tip obtuse or rounded.

Common, Purneah! Santal Parg., *Nusker*! Monghyr, *Mokim*! Ranchi, *Wood*! Manbhum, *Camp.*! Singbhum! Puri, *Walsh*! Fl., Fr. Aug.–Oct. Annual.
Peduncle glabrous below the spikes. Keel of glumes sometimes scaberulous.

2. **E. coracana,** *Gaertn.* Syn. E. indica, var. coracana, *J. D. H.* Marua, *H.*; Murha, *Beng.*; Kode, *K.*, *S.*; Mandia, *Or.* Also Mandua, Ragi, *vern.*

Stouter than *E. indica*, 2–4 ft. high with the leaves often far overtopping the stem ·2–·27″ broad with compressed loose sheaths and ligule of hairs. Spikes 4–7, suberect with their ends or whole spike frequently incurved, rhachis of spikes often pubescent at base, somewhat 3-gonous, or back flattened. Spikelets much congested, awnless, 3–6-fld. Flg. glumes more broadly ovate than in *indica*, and often with 1–2 nerves in the sides, variable in size, up to ·2″ long. Seed globose, dark brown, smooth in some varieties, at other times somewhat rugose, about ·07″ diam., with a depressed black hilum and slightly flattened on one side.

Cultivated only. Gya, *Mokim*! Monghyr, *Mokim*! One of the most frequent crops throughout Chota Nagpur and indeed throughout the province! Fl., Fr. Sept.–Nov.
This is probably the cultivated form of *E. indica* according to *Hooker* and others. It is often said to be a good fodder. This is not my experience, the leaves though soft have very tenacious vascular strands and I have noticed animals frequently reject them after chewing a few times. It is easily grown and the out-turn of grain very high and of good quality. The form with straight, not incurved, spikes is called *E. stricta* by *Roxburgh*.

3. **E. ægyptiaca,** *Desf.* Suntu bukuic', *S.*

Erect or geniculate at the base, 8″–2 ft. high, often proliferously branched at the thickened nodes. Leaves 2–6″ long by ·1–·2″ broad, rarely up to 10″ long, ciliate on nerves or midrib and margins; sheath hairy or ciliate above. Spikes stout, 3–6, ·5–1·3″ rarely 2″

long, spreading or suberect, peduncle hairy at base of spikes. Spikelets spreading at right angles from rhachis; gl. i acuminate, scabrid on keel; ii broadly ovate or suborbicular (when unfolded) suddenly contracted to a squarrose awn as long as itself, about ·2″ including the awn; iii to v usually perfect, shortly awned with awn about one-third the glume, keel scabrid; palea notched, nerves hispid; vi usually imperfect. Grain subglobose, flattened on one side of the hilum, which is not depressed, ·03–·04″ diam., very rugose.

Common as a weed of cultivation and in pastures.

Purneah! Santal Parg., *Kurz*! Gya, *Mokim*! Monghyr, *Mokim*! Chota Nagpur, common in Singbhum! Hazaribagh, *Clarke*! Fl., Fr. Aug.–Nov. Perennial? Probably throughout the province.

The seeds are ground into flour, of which cakes are made and eaten in times of scarcity. It is a good fodder.

23. DINEBRA, *Jacq.*

An annual leafy grass with flat leaves. Spikelets small crowded 2-seriate unilateral on short or slender 1–2-nate or whorled spikes which are again spicate on the rhachis of narrow panicles, not jointed at the base; rhachilla jointed at the base and elongate between the glumes, produced beyond the flowering glumes and bearing an imperfect gl. (always ?). Gl. 4–5, 2–3-flowering. i empty persistent, lanceolate, 1-nerved, awned or cuspidate; ii subequal or longer than i, similar; iii and iv very small, broadly ovate (when unfolded) hyaline, 1-nerved, subobtuse or subacute, neither cuspidate nor awned; palea as long, reduplicate, 2-nerved. Lod. 2. Anthers 3, small. Styles free. Grain oblong or ovoid, acute, trigonous, free (*Hooker* says wrinkled; the ripe grains do not appear to me wrinkled).

1. **D. arabica,** *Jacq.*

Stems 1–3 ft. tufted, geniculate at base or erect. Leaves 3–8″ by ·15–·17″, flaccid, finely acuminate, sparsely hairy. Panicles very various in length and length of the spikes, 4–12″ with close or distant spikes ·5–2″, which are opp., alt., or whorled, sessile, green or yellow, at first erect, then spreading or deflexed. Spikelets close imbricate on the broad flat rhachis; gl. i and ii ·2″ long (*Hooker* says ii one-fourth longer than i; they are subequal in my specimen), including the short aristate tip; iii and iv ·08–·1″, palea nearly as long. Grain brown, 3-angled, oblong.

Behar, *Kurz*! Apparently rare.

24. LEPTOCHLOA, *Beauv.*

Annual grasses with flat or involute leaves. Spikelets very minute, laterally compressed, alternate and unilaterally 2-seriate on the very slender spiciform branches of a lax panicle, sessile or minutely pedicelled, not jointed at the base, rhachilla jointed at the base and beneath each glume, produced between each glume and often beyond the terminal. Glumes usually 2 (sometimes 1–) –many flowering, membranous; i and ii subequal or unequal oblong, lanceolate or almost linear-lanceolate, 1-nerved; iii and other flowering glumes ovate (when unfolded), subacute or obtuse, 3-nerved, 1 nerve in the keel

and usually 1 near each margin ; palea shorter 2-nerved. Lod. cuneate. Anth. 3, short. Styles free. Grain oblong obovoid subglobose or 3-gonous, invested by the glume and palea.

Spikes ·5–3″, rarely 4″. Spikelets 2–3-fld., under ·1″ . . . . 1. *filiformis*.
Spikes 2–4″. Spkts. 4–6-fld., ·1″ long . . . . . 2. *chinensis*.

1. **L. filiformis,** *Roem. & Sch.*

Very slender 1–2·5 ft. high, tufted and geniculately ascending. Leaves flat, flaccid, 4–10″ long, about ·15–·27″ or less broad, sometimes sparsely hairy on the nerves and on the sheaths, ligule ·02–·03″ long, erose or setosely lacerate. Spikes ·5–3″ or up to 4 or even 5″ but exceedingly filiform with 2-nerved rhachis and spikelets only ·06–·08″ long, distant nearly their own length on the rhachis on pedicels ·01–·03″ long. Gl. i ·03–·04″ linear-lanceolate ; ii ·05–·06″ ; flg. glumes 2–3 rather shorter than ii, with median nerve and sub-marginal nerves microscopically hairy ; palea rather shorter, reduplicate. Grain ·02″ fusiform-oblong, pericarp adherent but slightly produced each end.

Apparently throughout the province. Shahabad, *Levinge* ! Gya, *Clarke*, *Mokim* ! Monghyr, *Mokim* ! Santal Parg., *Kurz* ! Ranchi, *Prain* ! Puri, *Walsh* ! Fl., Fr. July–Nov.

2. **L. chinensis,** *Nees.*

Stouter than *L. filiformis*, 2–4 ft. high with leaves 6–18″, flat or convolute, scaberulous, ligule short lacerate. Spikes 2–4″ or more. Spkts. ·1″ long with 4–6 flowering glumes. Gl. iii obtuse and apiculate. Grain loose obtusely trigonous, subrugose.

Said to be throughout India in moist places. Hot springs, Monghyr, *J.D.H.* ! Gya, *Clarke* !

Tufted. L. ·2–·3″ broad, numerous, erect or spreading. Panicle 6–9″ long.
The two species are scarcely more than varieties.

25. AGROSTIS, *L.*

Perennial, rarely annual grasses with usually flat leaves and small or very small spikelets in effuse or contracted panicles with capillary whorled branches, not jointed on their pedicels ; rhachilla not produced beyond gl. iii. Glumes 3 only, i and ii equal or unequal, keeled, 1- rarely 3-nerved, empty ; iii flg., membranous, 5-nerved, truncate, glabrous, with awn dorsal or 0, callus glabrous or with minute hairs ; palea nearly as long as its glume or shorter or 0, 2-nerved or nerveless. Lod. 2. Stamens 3. Grain free within the glume.

1. **A. brachiata,** *Munro.*

A very slender graceful grass 2–3 ft. high. Leaves 4–5″ by ·2–·25″, broadly linear, sheaths glabrous, ligule membranous ·06–·1″ long. Panicle very effuse 6–12″ long with brachiate flexuous branches up to 3–4″. Spkts. ·04–·06″ long on capillary clavate, subequal divaricate pedicels, fertile gl. about equal to the empty obtuse cymbiform ones, 5-nerved, with median awn, callus glabrous. Palea minute. Grain oblong as long as the glume.

Monghyr, *Ham.* (*Wall.* No. 3789, part of B only)! It is mixed up on one sheet with *Sporobolus Wallichii* which is at once distinguishable by its much longer narrower leaves and the ligule.

26. SPOROBOLUS, *Br.*

Perennial rarely annual, with flat or convolute leaves and small or minute spikelets in effuse or close or spiciform panicles, articulate on their pedicels with very short rhachilla articulate at the base. Glumes 3 awnless, i and ii nerveless or 1–3-nerved, membranous, unequal, persistent or separately falling; iii 1-nerved, longer or shorter than i or ii; palea often splitting between the two very close nerves. Lodicules minute or 0. Stamens 2–3, anthers short. Styles short free. Grain loose within the glume and palea, pericarp or its epidermis loose, deciduous, rarely adherent.

A. Gls. i and ii much shorter than iii. Spkts. not crowded :—
  1. Gl. ii not = ½ iii :—
    Very slender. Panicle usually effuse, sub-pyramidal. Spkts. ·04–·06″, rarely ·07″. Gls. i and ii truncate nerveless or ii acute . . . . . 1. *diander.*
    Stouter. Panicle oblong with short erect branches. Spkts. ·06–·09″ long. Gls. i and ii obtuse 1-nerved . 2. *indicus.*
  2. Gl. ii = ½ iii or more :—
    Panicle decompound, effuse. Spkts. ·07–·1″. Gl. i minute truncate . . . . . 3. *Wallichii.*

B. Gl. i shorter than ii and iii; gl. ii and iii subequal or ii rather longer :—
  1. Perennial. Panicle contracted :—
    Leaves with glabrous margins. Spkts. crowded . . 4. *tremulus.*
  2. Annual. Panicle effuse. Leaves sub-spinulosely ciliate (at least near base) :—
    Panicle oblong. Gl. i = ½ ii obtuse. Gls. ii and iii broadly ovate . . . . . 5. *pulchellus.*
    Panicle pyramidal. Gl. i minute, under ¼th ii, acute. Gls. ii and iii ovate-lanceolate . . . . . 6. *coromandelianus.*

1. S. diander, *Beauv.*

A tufted very slender grass 1–3 ft. high with very slender leaves up to 10″ by ·12″ rather strongly (about) 7-nerved beneath. Panicle 4″–1 ft. long, lanceolar or narrowly pyramidal with spreading or erecto-patent capillary solitary and fascicled branches, often without spikelets at the base. Spikelets ·04–·07″ long. Gl. i and ii subpersistent hyaline nerveless. i subquadrate, truncate and often erose, nerveless ·017″ long and as broad; ii ·03″ rhomboid-lanceolate, obtuse or acute (*F.B.I.* describes both as truncate!); iii length of spkt., it and its equally long palea gaping in fruit. Grain chestnut brown oblong or broadly obovoid-oblong, its pericarp (in boiled specimens) easily detachable.

Common. The following forms occur :—

α. Panicles up to 12″ long, open, of numerous spreading almost capillary 1-3-nate branches 1·5–2·5″ long which are again branched more than once, spkts. ·05–·07″ long. Ranchi, *Gamble*, *Wood*, etc.! Singbhum! Hazaribagh (spkts. only ·06″), *Clarke*! Santal Parg. (Rajmahal hills), *Kurz* (spkts. only ·05″)! Fl., Fr. r.s.–Nov.

β. Panicles 6–10″ long, linear-oblong with short patent or erecto-patent nearly simple branches ·3–·7″ long only. Spkts. ·04–·06 rarely ·07″ long. Ranchi, *Prain*! Manbhum, *Camp.*! Puri, *Walsh*! Fl. Nov.

γ. Panicle 4-6″ long much contracted with upright branches ·25–·35″ long, appearing more densely clothed with spikelets, all ·06″ long. Santal Parg., *Nuskerr*! Manbhum, *Camp.*!

One of the Manbhum specimens is called *S. indicum* in *Herb. Cal.* and this apparently accounts for the Chota Nagpur locality of that species in *Bengal Plants* (no others have been received from Calcutta). But all these specimens are in young flower and it seems to me that the character of the panicle is due to that only. The forms α and β are probably due to differences in vigour of the plants. They are not correlated with differences in the shape of the fruit.

2. S. indicus, *Br.*

A somewhat stouter plant than *S. diander*, 2–3 ft. high with leaves 8–24″ rarely ·3″ diam., margins smooth, ligule a few hairs. Panicle up to 15″, always very narrow with short erect branches not exceeding 1″ in length but not always separable from narrow states of *S. diander*. Spikelets a little larger, ·06–·08 rarely ·09″. The fruit is described as broadly obovoid in contra-distinction to that of *diander* described as obovoid-oblong but the specimens do not bear this out, and ellipsoid-obovoid fruits are found in this species and almost globose ones in *diander*.

Manbhum, *Camp.* Said to occur throughout India, but this appears the only locality from our area, and it is so young that it is difficult to be sure of it.

3. S. Wallichii, *Munro.*

Tall erect with long leaves over 12″ and only ·07″ wide, sheath densely shortly ciliate on the edges at least at the mouth, ligule short closely ciliate and base of blade somewhat hairy above it. Panicle very large, 12–18″ with capillary compound branches up to 4″ and very scattered spikelets ·07–·08″ rarely ·1″ long. Pedicels very unequal, the terminal much longer than lateral, not nearly so divaricate as in *Agrostis brachiata* (with which it is mixed on one sheet in the Wallich Collection), lateral ·1–·2″.

Monghyr, *Ham.*! Santal Parg., Rajmahal Hills, *Wall.* (No. 3769*a*)! Fl. Aug.–Jan.

Panicle oblong or sub-pyramidal, decompound, branches opposite and whorled, flowering towards the tips. Gl. i minute or about ¼rd iii, truncate (when unfolded), ii = ½ iii or longer, ovate, acuminate. Grain broadly obliquely obcordate, or oblong-obovoid and retuse, ·03″ long.

4. S. tremulus, *Kunth.*

A small grass from a minute herb 1″ high only to 8″ or rarely 12″, erect, strict, often tufted, from a knotted stoloniferous rootstock. Leaves short erecto-patent ·3–·75″ rarely 1″, about their own length apart, nearly up to the panicle. Panicle narrow 1–4″ with erect branches, rarely a few spreading. Spikelets ·07–·08″ long crowded articulate on very short pedicels half their own length or less; rhachilla readily disarticulate above the lowest glumes and these also separately falling. Gl. i about ¾ths iii, lanceolate; ii and iii subequal. Grain oblong.

Patna, *Wall.* (No. 3770)! Manbhum (Raneeganj), *Kurz*! In grassy places and ditches. Fl. May–Dec. Perennial.

Leaves flat or convolute with smooth margins, base usually hairy and ligule of a few hairs. Glumes all 1-nerved, palea as long as the glume.

Hooker states that the spikelets are sub-persistent on the pedicels. Lower Gangetic plain specimens are much larger than our specimens, with weak stems.

5. **S. pulchellus,** *Br.*

A very slender grass 6–24″ high with spreading or erecto-patent narrowly-lanceolate leaves 4–6″ long, up to ·2″ broad at base and tapering from base to apex, margins pectinately ciliate (sub-spinulose). Panicle elliptic-oblong, very delicate, with whorled capillary branches. Spikelets on secund small branchlets towards the tips of the branches, ·05–·06″ long. Gl. i = about ½ ii obtuse (with ciliate keels, *J.D.H.* I have not observed this). Gl. ii = iii broadly ovate acuminate. Grain ellipsoid 3-gonous ·03″ easily extruded from its pericarp (globose, *J.D.H.*).

Monghyr, *Wall.* (No. 8883)! Ranchi, *Clarke*! Hazaribagh, *Clarke*! Fl. Sept.–Oct. Annual.

6. **S. coromandelianus,** *Kunth.*

Densely tufted 3–9″ high with linear lanceolate leaves 1–3″ long, attaining ·2″ in breadth at base, often minutely papillose above, subspinulosely ciliate especially near base, flat; mouth of sheath villous. Panicle short and rather dense, pyramidal, 2″ or sometimes up to 6″, with 4–6 capillary subsecund whorled branches ·5–2″ long. Spikelets ·04–·05″ long on small secund branchlets. Gl. i minute nerveless, scarcely one-fourth as long as iii; ii = iii ovate-lanceolate acuminate. Stamens 2. Grain obliquely oblong or subglobose.

Patna, *Wall.* (No. 3764*b*)! No Orissa specimens except *Roxburgh's* collected on the Madras not the Bengal side. It is, however, widely distributed and will be probably found in other districts.

27. GARNOTIA, *Brogn.*

Erect perennial or annual grasses with flat or convolute leaves and small panicled solitary or geminate narrowly lanceolate spikelets articulate on their pedicels. Glumes 3, i and ii empty subequal, 3-nerved, acuminate, or ii obtuse, equalling or longer than iii, awned or not; iii bisexual, articulate at base, 1–3-nerved, very narrow, terete, acuminate or notched at tip, terminally awned, rarely awnless or 3-awned, palea with sides at base dilated into auricles which clasp the linear or oblong grain.

1. **G. stricta,** *Brogn.*

A tufted grass 1–2·5 ft. high with stems usually geniculating ascending and branched at the base, nodes bearded. Leaves flat ·1–·3″ broad, glabrous, hirsute or scabrid above, ligule short truncate. Panicle contracted 3–8″ long with upright branches in distant fascicles. Spikelets ·12–·15″ long. Gl. i and ii shortly ciliate at base; i lanceolate acuminate aristulate, membranous; ii as long obtuse and aristulate, linear-oblong; iii thickly membranous tapering to the ·3″ long awn, nearly as long as i with a linear palea ·09″ long slightly exceeding the ventrally compressed oblong grain.

Parasnath, *Clarke*! Fl. Oct.
The plant is variable; I have only described the Parasnath form.

28. POLYPOGON, *Desf.*

Annual or perennial with flat leaves. Spikelets minute, articulate on but not falling from their pedicels, laterally compressed, keeled, densely crowded on the short branches of a spiciform or lobed panicle. Gl. 3; i and ii equal concave keeled, 2-fid notched or entire, with a slender awn below the tip or from the sinus; iii articulate, much smaller, hyaline, sessile, truncate, toothed, awned or not; palea small 2-nerved. Lodicules falcate. Stamens 1–3, anthers small. Ovary glabrous, styles free. Grain obovoid, free within the glume and palea.

Panicle oblong or cylindric, close, not lobed. Awns of i and ii as long to many times as long as glume. iii shortly awned . 1. *monspeliensis*.
Panicle lobed. Awns of i and ii less than twice as long as the glumes; iii shortly awned or not . . . . . 2. *littoralis*.

1. P. monspeliensis, *Desf.*

A closely tufted small grass 2–10″ high only in our area (up to 2 ft. elsewhere). Leaves 1–4″ by ·1–·15″ (3–6″ by ·12–·25″ outside our area). Panicle cylindrical or oblong ·5–1·5″ long and ·3–·5″ diam., sometimes obscurely lobulate from the projecting lateral branches. Spikelets ·06″ long, minutely pubescent, easily detachable from their pedicels; gl. i and ii narrowly oblong obtuse or notched at the tip with awn from or from below the minute sinus, mostly 2–3 times as long as the glumes; iii oblong 2-fid easily detachable with its palea and grain, ·04″ long with a minute deciduous awn. Palea and grain nearly as long.

Manbhum, *Camp.*! Hazaribagh (Parasnath), *Clarke*! Fl. April. Annual.

2. P. littoralis, *Smn.*

Hooker states that "except by the uniformly shorter awns of the spikelets and usually broader lobed panicle, I find it very different to distinguish the annual form of this species from the common one of *P. monspeliensis*. In India *P. littoralis* does not descend to the plains." The seed is apparently however sometimes carried down by the rivers and a plant collected by *Kurz* in the Calcutta Herbarium appears correctly named as this.

Santal Parg., banks of Ganges near Sahebganj, *Kurz*! Fl. May.

29. ARISTIDA, *L.*

Annual or perennial usually slender grasses with slender usually convolute leaves. Spikelets panicled small, or long and slender with the rhachilla articulate above the two lowest glumes and often elongate. Glumes 3; i and ii empty, very narrow, keeled, persistent or tardily deciduous; iii narrow, convolute, acuminate, 2-sexual, tip produced into a long 3-partite (very rarely simple) awn; palea very narrow, embraced by the glume, sometimes minute or 0. Lodicules 2. Stamens 3. Styles distinct. Grain narrow, free within the convolute glume.

I. Awn not articulate on the glume (see also *redacta*) :—
A. Panicle very delicate effuse. Spkts. ·1″ long only . . 1. *Cumingiana.*
B. Panicle contracted. Spkts. far exceeding ·1″ :—
Spkts. ·2–·3″ long. Gl. i and ii awnless . . . . 2. *adscenscionis.*
Spkts. ·4–·7″. Gl. i and ii awned . . . . . 3. *setacea.*
II. Awn column twisted below trifurcation and articulate on the glume, or if obscurely articulate (*redacta*) then awn branches very unequal :—
Lateral branches of awn very short or 0 . . . . . 4. *redacta.*
Lateral branches of awn long . . . . . 5. *funiculata.*

1. A. Cumingiana, *Trin.*

A very pretty grass resembling an English "Bent," tufted, very slender, 3″–1 ft. high with very narrow or filiform leaves at or near the base, the greater part of the plant being the graceful decompound panicle with small often purple spikelets ·08–·1″ long at the ends of the capillary branches and pedicels. Awn inarticulate, very fine, centre branch longest, about ·2″.

Along the borders of fields, etc.! Ranchi, *Prain*! Hazaribagh, *Clarke*!, etc. Manbhum, *Camp.*! Sambalpur! Fl. Oct.–Dec. Annual.

Stems smooth. Leaves convolute, 1–3″. Panicle with suberect or effuse branches, lower usually 3-nate, capillary, scaberulous, as are the pedicels. Gl. i ·05–·07″; ii ·08–·1″; iii ·04–·05″.

2. A. adscenscionis, *L.* Kharang jonok', *S.*

Tufted, very slender 1–3 ft. high with filiform leaves and a contracted pale panicle of slender spikelets ·2–·3″ long (without the awns). Gl. i about ·15–·2″, not awned, pungent or very acute; ii longest with inrolled edges after opening, obtuse or emarginate and with slightly excurrent midrib; iii with 3-fid awn ·3–·5″ long; rhachilla very short bearded below glume.

A common weed, chiefly on sandy ground. Gya, *Mokim*, etc.! Santal Parg., *Nusker*! Monghyr, *Kurz*, etc.! Singbhum! Manbhum, *Camp.*! Hazaribagh, *Prain*! Fl. Aug.–Jan. Annual (or perennial, *J.D.H.*).

Glabrous. L. short or often as long as stem, convolute or flat, and up to ·05″ wide at base. Panicle 4–8″, often with distant secund clusters of main branches, rarely purplish. Gl. iii glabrous or with a row of minute bristles on mid-rib, awns scabrid, inarticulate at base, rhachilla somewhat pungent.

3. A. setacea, *Retz.* Ghora-lenji (Horse's-tail), *Or.*; Kharan-ghas, *S.*

Stouter than the last two, 2–4 ft. high, simple or fastigiately branched. Panicle 6–15″ contracted inclined feathery with rather close clusters of branches and secund spikelets ·4–·7″ long (without the awn). Gl. i with a short awn; ii about ·6″ long with its short awn but rather variable, tip sometimes minutely 2-toothed; iii tapering imperceptibly into the rigid strong base of the 3-fid awn, the middle branch of which is usually over 1″ long (·5–1·5″, *J.D.H.*), sometimes all three branches over 1″. Rhachilla ·04–·06″ long, very pungent, white bearded.

A weed of thin, poor forest, on sandy gravelly or kunker soil, or on heavily grazed open lands. Gaya, *Nusker*! Hazaribagh, *Clarke*! Manbhum, *Camp.*! Puri, *Walsh*! Angul, common! Sambalpur, common! Fl., Fr. Aug.–Feb. Perennial.

Leaves often overtopping the inflorescence, sometimes flat when green and up to ·12″ wide, sheaths at base of stem open. Panicles pale, branches scaberulous, the ultimate often bearing a central short-pedicelled spkt. and 2 lateral long-pedicelled spkts. reminding one of the sessile and ped. spkts. of *Andropogoneæ*. Awn microscopically scaberulous, inarticulate at base.

A pest from its barbed fruiting glumes penetrating the clothes, helped by the 3-fid awns. Cattle do not touch it.

4. **A. redacta,** *Stapf.*

Very slender 6″ to 2 ft. high with filiform leaves and effuse panicles. Leaves at base and sheaths with fine hairs. Branches capillary, mostly 2-nate ending in 1–3 erect or ascending spikelets. Gl. iii very slender and very gradually tapering into the twisted base of the awn which has two very fine branches (sometimes 0) about ·2–·25″ long and a very long slender branch often 1″, whole length of glume and column up to trifurcation far exceeding glumes i and ii which are subequal and about ·5″ long.

Manbhum (near Barakar), *Kurz*! Common in Central Provinces and therefore likely to be found in other districts of our province. Fl. Sept.–Oct. Annual.

Among a group of specimens collected I find one with all three branches of the awn equal, but it is not otherwise distinguishable from *redacta*.

The *F.B.I.* states that "the awn readily separates from the glume, but without any indication of the joint." When green the awn cannot be separated. In some specimens the joint *is* visible, the glume minutely scabrellous, and I am inclined to think this is a form of *funiculata*.

5. **A. funiculata,** *Trin. & Rupr.*

Stems many tufted geniculately ascending, 1–2 ft. high. Leaves at base and sometimes sheaths with sparse very long weak hairs. Panicle contracted or narrow, lax with very short branches. Gl. i and ii ·5″ but variable (and up to 1″, *J.D.H.*), more or less aristate-tipped, scabrid on the nerves; iii 1–1·2″ to trifurcation of awn and awn with three very long slender branches 1–1·5″ long. In this species the junction of column of awn with the ·2″ long glume is distinct.

Gaya, *Nusker*! Fl. Oct.

Gl. iii is scaberulous below the awn-column; callus pungent, bearded except at the extreme tip.

30. PEROTIS, *Ait.*

A slender grass with short leaves and a feathery spike of very narrow awned spikelets articulate on the slender simple rhachis. Glumes 3, i and ii empty subequal narrowly linear tapering into long capillary awns; iii minute, flowering, muticous. Palea and lodicules hyaline. Stamens 3, anthers very short. Styles very short connate at base, stigmas short. Grain much longer than its glumes, narrow.

1. **P. latifolia,** *Ait.* Maria-buch, *Gond.*

A prostrate and ascending small grass 3–10″ high or occasionally 18″, branched from the root, stem leafy. Leaves ·5–1″ rarely 1·5″ ovate to lanceolate with cordate often bristly or ciliate base; sheath short, ligule ciliate. Spikes 2″ only in some plants, usually 3–6″ long slender, rhachis and short pedicels pubescent. Spkts. often purplish, scattered all round the rhachis, ·08″ long with the 2 awns several times longer. Gl. i and ii laterally compressed, somewhat pubescent and ciliate, 1-nerved; iii very small hyaline.

Characteristic of dry over-grazed sandy soils. Purneah, *King*! Santal Parg., *Cal. Herb.*! Gya, *Mokim*! Ranchi! Manbhum, *Camp.*! Puri, *Walsh*! Fl., Fr. Sept.–Nov.

31. TRAGUS, *Hallier.*

A low rather rigid grass with short flat leaves. Spikelets subarticulate or not articulate on their pedicels, 1-fld., and geminate (appearing like a single 2-fld. spikelet) or 3–5-nate on the very short branches of a narrow spike. Glumes i and ii absent; iii thickly coriaceous, lanceolate cuspidate, 5-ribbed with a row of spines on each rib; iv embraced by iii, chartaceous, lanceolate, flat, 1-nerved with a membranous obtuse involute nerveless (or faintly 2-nerved below) palea. Stamens 3, anthers long-linear. Styles short distant. Grain free within the glumes, linear.

1. **T. racemosus,** *Scop.*

Stems 4–8″ high, leafy and with many spreading and flowering branches from the base (from stolons after the first year, *J.D.H.*). Leaves ·5–1·5″, ovate to linear with margins and mouth of sheath setose, surface often scabrid. Spike 1–4″ at the end of every branch, rhachis pubescent. Spikelets crowded, mostly geminate face to face, sessile on their common pedicel, ·1–·17″ long.

Singbhum, on high ground! Manbhum, *Gage* (Raniganj, close to Manbhum)! Fl., Fr. Aug.

A very easily recognised grass from the curious paired densely muricate or spinose spikelets.

32. ZOYSIA, *Willd.*

A small much branched rigid glabrous grass with subulate pungent leaves. Spikelets small ovoid or lanceolate subimbricate sessile or shortly pedicelled and appressed to a rigid notched inarticulate rhachis. Spkts. articulate at their base. Glumes 2, i absent; ii empty, coriaceous, laterally compressed, shining and nerveless with hyaline margins connate below; iii much smaller, membranous, linear-oblong, obtuse, complicate, palea short, hyaline or 0. Lodicules 0. Stamens 3, anthers long. Styles very long, distinct with long stigmas. Grain free within the glumes.

1. **Z. pungens,** *Willd.*

A small stiff wiry grass. Stems creeping and rooting, with many upright or ascending branches 3–8″ high with squarrose short subulately folded and sharply pointed leaves ·2–1″ long. Spikes ·5–·7″ with sinuous rhachis, bearing in the sinuses narrow brown polished lanceolar-linear spikelets ·1–·12″ long with compressed tips. Pedicels very short clavate or 0.

From Mutlah (near Calcutta), Kew Herb.! to Ganjam, *Fischer*! along the sandy shores. No doubt therefore on the Orissa Coast. Fl. April, Aug.

33. ORYZA, *L.* Rice.

Grasses with long flat leaves and spikelets articulate on the slender branches of an elongate rarely spiciform panicle, oblong, laterally compressed, 1-fld. Pedicels annular at tip. Glumes 2–3, i and ii much the smallest, empty, scale- or bristle-like, rarely 0; iii chartaceous or coriaceous, obtuse acute or awned, strongly 3–5- or obscurely

7–9-nerved; palea (gl. iv of most authors) as long as the glume, keeled. Lodicules 2, 2-lobed, rarely entire. Stamens 6, anthers linear. Styles short free, stigmas laterally exserted. Grain narrow, free or adnate to the glume and palea.

The spikelet of *Oryza* has been variously construed. The above is the account (with few modifications) as given by *Hooker* in the *F.B.I.* *Dr. Stapf* considers that the usual 2 outer empty involucral glumes are absent, that the next 2 (scales or bristles) are empty florets (valves); they fall with the fruit. He also considers the fourth glume a palea.

Cooke describes the floral glume as 5-9-nerved. It is only 3-nerved in the common wild rice unless the striæ be counted when it is many nerved.

1. **O. sativa,** *L.* Dhan, *H.*, Beng.; Baba, *K.*; Uri, *S.* (these names apply to the growing plants when cultivated); Deodhan, *H.*; Oridhana, *Beng.*; Urihoro, *S.*; bir-baba, *K.*; Balunga, *Or.* (the wild rice). Numerous different names are applied to the several cultivated varieties.

Annual with creeping or floating and erect stems 2–10 ft. Leaves 1–2 ft. by ·25–·3″ or more, striate, scaberulous. Sheaths smooth, ligule long 2-partite. Spikelets awned in the wild plant, shining, in finally drooping panicles. Gl. i and ii $\frac{1}{4}$–$\frac{1}{3}$ length of iii lanceolate; iii hispid above, dorsally spinescently ciliate, striate with minute dots.

The wild plant occurs in marshy localities in various districts, especially Sambalpur, Chota Nagpur and the Santal Parg.! Cultivated in all districts in both lands which are irrigated or submerged during the rains and on non-submerged lands. For accounts of the different varieties and crops see *Watt* (*Dict. Ec. Prod.*, v, 502 *et seq.*).

The following is a more special account of the wild rice collected in our area:

Lower parts submerged. L. 6–15″ long, ·25–·4″ broad, margins very scabrid with minute bristles, sheaths inflated many-nerved, ligule erect ·4–·5″ long with (in my specimen only) two lateral long subulate ciliate fleshy processes at its base in the angles between the sheath and the blade. Panicles rather effuse, sometimes scarcely exserted from the uppermost leaf-sheath (but my specimen is only in flower). Spikelets ·25–·27″ long, yellow, shortly pedicelled on the flexuous scabrid branches, long awned. A half-annular thickening below glume i may represent the rudiment of a suppressed glume. Gl. i lanceolate pale ·1″ long keeled acuminate, not laterally compressed, margins scaberulous; ii similar and subequal rather distant on the much thickened rhachilla, rhachilla with a callus thickening between ii and iii; iii sparsely hispid and minutely closely granulate or punctate, much laterally compressed, cymbiform keeled and with two lateral ridges, many-striate; apex with pink glandular swellings and then terminating in a hispid awn 2·5–3″ long, palea similar in texture, markings, spinulose hairs and glands, but more oblong (less deep), equal or a little longer, with white margins to which the subquadrate lodicules are partly adnate each side. Ovary only ·03–·04″ long. Grain not ripe.

Purneah, *Ham.*! Sambalpur! Gya, *Mokim*! Puri, *Walsh*! Manbhum! Fl. chiefly Oct. but also as late as Feb.

2. **O. granulata,** *Nees & Arn.*

Rootstock woody. Stems slender round polished tufted. Leaves lanceolate-linear, attaining 9″ by ·7″ but mostly much smaller and only about 2–3″ by ·2″ near top of stem, nerves 2–5 each side of midrib, sheath very long smooth striate with a very short ligule and ciliate auricles. Spikelets ·2–·25″ on the flexuous rhachis of very slender long-peduncled simple or nearly simple racemes, rarely a

short branch at the base of raceme. Pedicels ·2″. Gl. i and ii minute or 0; iii oblong scarcely cymbiform, the keel and two lateral ridges rounded or obscure; both glume and its palea granulate (not regularly or so minutely punctate as in *sativa*), tip rather horny but no sign of an awn.

Along rivers in jungles. Rajmahal Hills (Sant. Parg.) *Kurz*! Hazaribagh (Parasnath), elev. 2000–2500 ft. *Clarke*! Fl. Oct.–Nov.

34. LEERSIA, *Sw.*

Slender marsh grasses with narrow flat leaves and spikelets in slender contracted usually nodding panicles, very similar to those of *Oryza* but glumes i and ii entirely suppressed. Glume iii strongly laterally compressed, oblong, 3–5-ribbed, thinly coriaceous, awnless, keel and margins spinulosely ciliate; palea (glume of some authors) similar in texture but more slender, as long, laterally compressed, 3-nerved. Lodicules 2. Stamens 6–3 (rarely fewer). Grain oblong free within the glume and palea.

1. L. hexandra, *Sw.*

A slender grass 2–3 ft. high from a rooting geniculate base, nodes hairy. Sheaths and leaves striate very scabrid, blade 3–12″ by ·25–·3″, narrowed at base, acuminate, ligule truncate. Panicle 2–4″ long with slender distant branches ·5–3″ long, often again branched, flexuous. Tip of pedicel not much dilated. Spikelets ·13–·15″ long, green. Gl. iii 5-ribbed (including the marginal) cymbiform with a short obtuse cusp; palea much more slender 3-nerved, keel bristly. Stamens 3 or 6 in the same inflorescence.

Jheels and marshes. Purneah, *Kurz*! Ranchi, *Wood*! Manbhum, frequent, *Camp.*! Hazaribagh, *Cal. Herb*! Fl., Fr. Oct.–Dec.

35. HYGRORHIZA, *Nees.*

A floating aquatic with short broad leaves and few lanceolate 1-fld. spikelets articulate on their pedicels on the spreading branches of a short broad panicle. Pedicels short or rather long with annulate tips. Glume solitary (involucral glumes suppressed), membranous, 5-nerved, narrowed into a long awn, keel and nerves ciliate; palea acuminate 3-nerved, keel scabrid. Lodicules gibbous. Stamens 6, anthers very long. Styles short free, stigmas laterally exserted. Grain narrowly oblong, free within the unhardened glumes.

1. H. aristata, *Nees.*

Stems floating with whorled feathery green roots from the nodes. Leaves ovate, ovate-lanceolate or oblong, ·7–3″ long by ·5–·7″ broad, rounded more rarely acute, base rounded or cordate, usually shortly petioled, sheaths much inflated sometimes pubescent, mouth auricled, ligule 0. Panicle 2–3″ with few spreading branches, lower whorled often deflexed. Spikelets ·3″ (without the awn which is ·3–·4″); palea ·25–·3″ subaristate-acuminate with white margins. Pedicels articulate far below the tip.

Santal Parg., *Mokim*! Gya, *Mokim*! Ranchi, *Wood*! Singbhum! Fl. Oct.

36. THYSANOLÆNA, *Nees.*

Very large with solid stems and large distichous leaves. Panicle very large effuse decompound with crowded long compound suberect branches, branchlets bearing myriads of subsecund very minute 1-fld. spikelets obscurely jointed in their pedicels, pedicels often in pairs articulate on the branchlets. Glumes 4, i shortest, about half spikelet or less, membranous, concave nerveless; ii similar but rather longer; iii longest very acuminate empty 1-nerved, hardening; iv rather shorter membranous ciliate with spreading (or erect) white hairs, palea short, truncate. St. 2–3, anthers broadly oblong. Styles free. Grain most minute, free within the hardened glumes.

1. **T. agrostis,** *Nees.* Dodri, Gara-jonor (ravine-broom), *K.*; Karsar, bushnia, *S.*; Phulbari, *Gond.*; Jopono, *Birja.*

A very large bamboo-like or reed-like grass 5–10 ft. high with stems often ·5″ diam., large broad flat oblong-lanceolate leaves often 18″ by 3″ and panicles up to 3 ft. by 2 ft. Spikelets variable in length ·03–·06″ long.

On shady slopes in the forests but especially on damp steep banks along ravines and watercourses. Rajmahal Hills! All the forest districts of Chota Nagpur, ascending to the top of Parasnath and the *pats* in ravines! Sambalpur! Fl., Fr. May–June.

Leaves usually broadest above the rounded or cordate base, punctulate, margins nearly smooth, mouth of sheaths somewhat hairy, ligule truncate nearly obsolete. Panicle-rhachis glaucous, main branches often 1 ft. long, swollen and pubescent or tomentose at the axils. There may be two varieties. In our area the glumes ii and iv are subequal and only ·03–·04″ long, in the Jalpaiguri district gl. iii is ·06″ long. In our plant the cilia of iv spread widely in flower. *Hooker* describes them as erect, which of course they are in the bud, and possibly also in fruit, though this seems unlikely.

The panicles are used for brooms.

37. ARUNDINELLA, *Raddi.*

Grasses of very various habit and aspect. Spikelets minute to rather large, not jointed on their pedicels, 1-2–fld., in panicles or panicled spikes. Glumes 4; i usually ovate acute or acuminate shorter than the next two, 3–5-nerved; ii lanceolate or ovate-lanceolate acuminate or subaristate, 5- rarely 7-nerved, longest; iii subacute or narrowly truncate 5–7-nerved paleate, male or neuter; iv smallest, 2-sexual, articulate at the base and deciduous with the grain, membranous in flower, subcoriaceous and scaberulous in fruit, with a terminal subgeniculate awn with lower part twisted or awnless or sometimes with 2 very slender awns lateral to the terminal, base usually bearded. Styles 2 free or connate below, stigmas long. Grain free within glume iv.

I. Glume iv awned:—		
A. Awns 3, two lateral capillary.	Tall perennial . .	1. *setosa.*
B. Awn solitary:—		
Spikelets minute in delicate panicles.	Annual . .	2. *tenella.*
Spkts over 1″ long.	Tall perennial . . .	3. *braziliensis.*
II. Gl. iv with awn short or 0.	Spkts. spicate . . .	4. *Wallichii.*

1. **A. setosa,** *Trin.* Jharu, Motamui-jhar, *K.*; Buru lukui-ghas, *S.*

A cæspitose slender grass 3–4 ft. high with thick stoloniferous rootstock, smooth glabrous stems, flat or involute setaceous acuminate

leaves 6–9″ on the stem (radical longer) and ·2–·5″ broad. Panicle sometimes 9″ long, green grey or purple with long suberect sub-solitary or 2–4-nately whorled branches 3–5″ long. Spikelets ·2–·25″ (without the long awn of the fertile glume), in unequally pedicelled pairs, narrowly lanceolate acuminate. Gl. iv ·07–·08″ long with a long very slender awn ·25–·5″ long with a black thicker twisted base and also with 2 slender tails or short very capillary awns ; black and scaberulous when ripe and wrapping the grain, base villous.

Chiefly on rocky ground in the forests where it is often gregarious especially on dry hills. Rajmahal Hills! All districts of Chota Nagpur! Sambalpur! Fl., Fr. Sept.–Dec.

Rootstock nodose developing early the next season's young pointed shoots. L. margin scabrous and ciliate with long rather rigid hairs (but these are seldom seen in herbarium specimens), ligule short truncate. Rhachis with scabrid angles. Lower spkts. sometimes reduced to empty glumes. Gl. i cymbiform strongly 3-nerved, awned; ii 5-nerved long beaked; iii 3-nerved membranous with hyaline palea.

Used for brooms.

2. **A. tenella,** *Nees.*

A very elegant and delicate grass, 6–20″ high, sometimes the whole plant reduced to a large panicle with a single leaf. Glabrous. Leaves from ovate- to linear-lanceolate 2–14″ long, up to ·6″ broad, acuminate, membranous. Panicle very large for the plant 2–10″ long by nearly as broad with long slender spreading branches and capillary branchlets and pedicels. Spikelets minute innumerable, only ·06″ (exc. the delicate awn of iv), on pedicels many times longer than themselves, glabrous or sparsely hairy.

Chota Nagpur. Manbhum, *Camp.* ! Ranchi, *Clarke* ! Hazaribagh, *Clarke*, on the mountains and along the Trunk road. Also mountains of Central Provinces and possibly common though not often collected. Fl., Fr. Sept.–Nov. Annual.

Stem glabrous or usually with few very delicate hairs. Leaf-sheaths rarely hairy, ligule short hairy. Spikelets with their pedicels often in pairs on a capillary peduncle. Gl. i ·04″ 3-nerved; ii longest finely acuminate 5-nerved; iii longer than i acuminate ; iv ·03″, when ripe deep brown and wrapping round the grain, scabrid, base with a pencil of hairs, awn ·15″ basal half brown.

3. **A. brasiliensis,** *Raddi.* Syn. A. nepalensis, *Trin.* ?

A stout often very tall grass attaining 15–20 ft. but usually much smaller (unless the smaller kind is another species ?), from a stout hard creeping rootstock. Leaves 6–18″ by ·17–·9″, with more or less dense hairs inside towards the base which meet those of the ligule and become indistinguishable from them. Panicle 6–20″ with very numerous fastigiate rigid, fascicled or subverticillate branches about one-fourth as long as the main rhachis, usually simple and sulcate, bearing more or less secund spikelets densely imbricate in several series. Spkts. lanceolate acuminate ·14–·16″ long, longer than their pedicels one of which is about ·1″, the other very short. Gl. i narrow ·12″, 3-nerved, keel scabrid ; ii longest subaristately acuminate 5-nerved ; iii about ·12″ ovate-lanceolate with centre nerve and 2 others each side near the margin, glabrous or base with thin hairs, paleate, male ; iv oblong-lanceolate ·1″ scaberulous with a terminal caducous awn about ·12″ long, base of glume bearded or with few thin hairs.

Duars! and Sikkim Tarai (the large form)! and no doubt also in Purneah. Fl. Oct.

4. **A. Wallichii,** *Nees.*

A robust grass 1–3 ft. high with a woody creeping or tufted rhizome. Very different in appearance from any of the others, the spikelets being densely 3–4-seriately imbricate on the outer side of the short spiciform branches of a strict contracted panicle 4–15″ long. Spiciform branches ·7–1·7″ long suberect stiff, lower sometimes whorled in threes, rhachis angular scabrid. Spikelets sparsely setose on the nerves ·09–·12″. Gl. iv ovoid or lanceolate with a short fine awn or awn 0.

Damp places. Chiefly over 3000 ft. in Chota Nagpur but in the plains in Purneah, *Kurz*! Ranchi (over 3000 ft.)! Hazaribagh (Parasnath) *T. Thoms.*! Fl., Fr. Aug.–Nov.

Nodes of stem sometimes bearded. L. 12–18″ by ·3–·7″, glabrous or hairy and sheaths often very hairy with tubercle-based hairs, ligule of hairs. Rhachis of panicle ridged shortly pubescent and often also hairy. Gl. i ovate sometimes sub-aristate 3–5-nerved; ii ovate acuminate 5-nerved, longest; iii oblong or ell., subacute or obtuse 3–5-nerved male, with 2-nerved palea as in iv; iv naked at the base. Pedicels short stout.

38. ISACHNE, *Br.*

Perennial, with small or minute subglobose or obovoid spikelets in loose panicles and *not* or obscurely articulate on the pedicel. Glumes 4, often all separately deciduous from a minute rhachilla; i and ii subequal convex, herbaceous; iii and iv very similar and indurated or iii larger flatter and rather thinner, both paleate and 2-sexual or iii more often male only; iv articulate and often stipitate on the rhachilla, hemispheric, coriaceous, female or 2-sexual. Lodicules very minute. St. 3, rarely 4–6. Grain free within the hardened glume and pale.

The genus appears to have affinities with the *Pooideæ*.

Ascending. L. 1–3″ linear-lanc. to lanc. Spkts. ·08″ . . 1. *australis.*
Prostrate. L. ·3–1″ lanc. to ovate-lanc. Spkts. ·05–·07″ . . 2. *miliacea.*

1. **I. australis,** *Br.*

A pretty grass with tufted ascending stems from a creeping branched base 8″–2 ft. high, short lanceolate or linear-lanceolate leaves 1–3″ long, and lax panicles 2–4″ long of small subglobose green or purplish spikelets ·08″ long at the ends of the capillary flexuous glabrous or obscurely scaberulous branchlets. Gl. i and ii subequal 6-nerved or more, shortly hairy glabrous or setulose; iii and iv with incurved edges as long or iii rather longer flatter and thinner, shining, iv glabrous or pubescent.

In marshy ground. Purneah, *Kurz*! Ranchi, common! Hazaribagh, *Clarke*! Singbhum! Fl., Fr. Sept.–Dec.

Leaves subscaberulous above or on both surfaces, margins ciliolate, not or very slightly thickened, about 7-nerved beneath, striolate above, the midrib not more prominent than the other nerves, sheath smooth, with mouth and often margins ciliate. Panicle pyramidal and open when mature, pedicels slightly clavate at the tips.

2. **I. miliacea,** *Roth.*

A small grass with very slender widely creeping prostrate and

shortly ascending stems rarely 4–8″ high, often growing in masses with interlaced roots. Leaves ovate-lanceolate or lanceolate ·3–1″ long, usually spreading nerveless or nearly so, glabrous or sparsely hairy on both surfaces. Panicles 1–2″ loose with lower branches ·7″, or contracted. Spikelets oval ·05–·07″ long, glabrous, rarely setulose.

Purneah, *Kurz*! Fl., Sept.–Oct.

39. PENNISETUM, *Pers.*

Annual or perennial usually tall grasses with the spikelets involucellate by scabrid or plumose bristles on the rhachis of a very contracted spiciform panicle appearing sometimes as a simple spike. Spikelets 1–2-fld. not articulate on their pedicels, 1–3 in each involucel which is often deciduous together with the spkt. Glumes normally 4, but i sometimes reduced to hairs or 0, if present always small; ii and iii 5-nerved hyaline; ii often longest (sometimes absent in cultivated species); iii palate or not, male or neuter; iv coriaceous, fem. or 2-sexual, articulate at base and falling separately. St. 3, anthers linear. Styles and stigmas long, free or connate at base. Grain free within the glume from narrowly oblong to orbicular (in cultivated plants).

I. Anther-cells with bearded tips. Styles connate:—
  Robust cultivated plant with stout spike . . . . . 1. *typhoideum.*
II. Anther-cells not bearded:—
  A. Bristles not plumose . . . . . 2. *parviflorum.*
  B. Inner bristles copiously plumose:—
    1. Involucel pedicellate with 2–5 spikelets . . . . 3. *orientale.*
    2. Involucel sessile with 1–2 spikelets:—
      Spikelets shortly pedicelled, 1–2 in each involucel, somewhat villose. Bristles (inner) densely woolly-villose . 4. *pedicellatum.*
      Spikelets sessile in the involucel, solitary, glabrous, inner bristles with close straight villi . . . . 5. *setosum.*

1. **P. typhoideum,** *Rich.* Bajri, *H.*; Tuti, *K.*; Lendha, *S.*; Spiked Millet.

A tall erect usually stout annual 3–6 ft. high, rooting at the lower nodes, upper nodes sometimes woolly, densely pubescent under the inflorescence. Leaves 1–3 ft. long by ·25–2″ broad, sheath rather inflated, ligule of hairs. Spikelets ·13–·18″ long crowded into a compact cylindrical spike of very varying dimensions, usually 4–8″ in the commoner forms by ·25–1·2″ diam. with hairy or woolly rhachis, they are in clusters of 1–8 on abbreviated hairy branchlets concealed by the involucels of scabrid and ciliate bristles as long as or exceeding the spkt. Gl. i minute or 0, orbicular or subquadrate 1–3-nerved; ii rudimentary or 0 or up to ½ iv, truncate obtuse or retuse 3-nerved, very rarely resembling iv; iii paleate or not, male or neuter, 5-nerved, truncate and apiculate or obtuse; iv coriaceous or herbaceous, ovate, acute, 5–7-nerved; palea very broad, truncate, ciliate at tip and back with 2 approximate excurrent nerves. Lodicules 0. Grain oblong, obovoid or pyriform, free with exposed top.

Cultivated in small quantities throughout our area, more especially in the Northern Tract and on the Central plateau! Monghyr, *Mokim*!

The Monghyr plant is a very small variety with spikes 3–4″ long, ·4–·5″ diam. in flower.

2. P. parviflorum, *Trin.*

Erect and rather slender with a general resemblance to *setosum* and *pedicellatum*, stem and rhachis both glabrous (or slightly rough). Spike narrow erect tapering purple 3–5″ long by ·3″ (without the bristles). Spikelets ·12–·14″ long, close but not clustered on the undulate-toothed angles of the rhachis. Bristles all free to the base, unbranched and scaberulous, without any cilia, some attaining ·6″ long.

Damuda Ghats (Hazaribagh), *Gamble*! Hazaribagh, *Clarke*! Manbhum, *Camp.* Parasnath. Fl., Fr. c.s.

Leaves suberect, 4-10″ by ·17–·3″, base and mouth of sheath ciliate. Gl. i minute suborbicular; ii length of spkt. 5-nerved truncate cuspidate; iii 5-nerved truncate toothed paleate male; iv lanceolate obtuse nerveless shining.

3. P. orientale, *Rich.*

A perennial 2–6 ft. high from a densely tufted often stout creeping branched rootstock. Leaves 1–2 ft. by ·17–·5″, narrowly linear, glabrous or hairy. Panicle 10″ long with very patent mostly secund spikelets ·75″ long including the purple bristles, rhachis hairy. Spkts. ·16–·17″ long lanceolate, 2–5 in each involucel which has hispid shortly branched pedicels.

Parasnath, *Clarke*! Fl. Oct.

Rhachis of spike stout, subterete. Outer spkts. of a cluster often imperfect, bristles ·6–·75″ long, very slender, flexuous, free at the base, very unequal, villous below. Gl. i ovate or oblong, nerveless, as long as iii; ii ovate-lanceolate 3-nerved; iii aristately acuminate, 5-nerved; iv aristate shining, longer than ii.

4. P. pedicellatum, *Trin.*

A handsome grass 1–5 ft. high, branched from base and often fastigiately branched above with flaccid leaves 6–10″ by ·25–·9″ broad and reddish dense spikes 1·5–3″ long conspicuous by the involucral tufts of densely plumose bristles. Spikelets solitary and geminate, one or both shortly pedicelled, ·17″ long. Bristles in sessile groups of 15–22, very unequal, longest attaining ·5″, inner densely cottony-villous in the lower half or three-fourths. Gl. i very small oblong woolly or reduced to a tuft of villi; ii longest hyaline or chaffy lanceolate shortly awned or cuspidately acuminate 5-nerved (7-nerved, *F.B.I.*), sparsely villous; iii ·1–·12″, oblong truncate 5–3-nerved often minutely toothed and with minute bristles or cilia at tip; iv broadly lanceolate but margins infolded, tapering to the truncate minutely ciliate or hispid tip, coriaceous and polished when ripe.

In rocky places, often subgregarious locally. Behar, *Hope*! Monghyr, *Kurz*, etc.! Gya, *Mokim*! Ranchi *Gamble*, etc! Hazaribagh, *Prain*, *Clarke* etc.! (common in Koderma Forest)! Palamau, common! Manbhum, *Camp.*! Fl., Fr. Oct.–Nov.

This has been relatively often collected compared with many other more common grasses, probably from its striking usually pink or purple inflorescences.

5. P. setosum, *Rich.*

Very similar to *P. pedicellatum* and possibly only a variety of that species, the characters employed to separate them being vague in practice. The bristles are said to be sparsely ciliate, they are better described as somewhat less and more shortly villose than in *pedicellatum* and the villi straight, *i. e.*, less woolly, often unilateral, sometimes

they are merely scabrid.* Spikelets always solitary in the involucel and glabrous and (in specimens seen by me) always sessile (but these two characters are *not* usually given as specific). Gl. i minute or 0, glabrous ; ii with truncate conspicuously 3-toothed tip, also glabrous.

Santal Parg., *Kurz*, etc. (one specimen is from near Sahibganj, where the other species, *pedicellatum*, has also been collected)! Manbhum, *Clarke*. Hazaribagh, *Gamble*, etc.! Orissa, *Walsh*! Fl., Fr. Oct.–Dec. (The Palamau specimen mentioned in *Fl. Chota Nagpur* I have now transferred to *pedicellatum*.)

40. SETARIA, *Beauv.*

Grasses of various habit. Ligule of hairs. Spikelets clustered, rarely solitary on the short branches of spiciform or narrowly pyramidal panicles articulate on very short pedicels, most of which bear or the branchlet below them bears, 1–many scabrid or barbed bristles which also often end the rhachis (supposed to be barren branchlets). Glumes 4, awnless, membranous, i small, 3-(5-)nerved ; ii usually 5-(7-) nerved ; iii 5–7-nerved, as long as or longer than ii ; iv convex coriaceous about as long as iii, 2-sexual, 3-androus. Grain free within the hardened glume and 'palea.

I. Bristles below the spkts. solitary. L. more or less plicate :—
  Perennial. L. very plicate. Panicle over 6″, rhachis scabrid . . . 1. *plicata.*
  Annual. L. slightly plicate. Panicle under 6″. rhachis hairy . . . 2. *rhachitricha.*
II. Bristles below the spkts. clustered. L. not plicate :—
  A. Bristles not retrorsely barbellate :—
    1. Gl. iv smooth. Bristles 2-3 below each spkt. Cultivated . . . . . 3. *italica.*
    2. Gl. iv rugose :—
      Pan. spiciform continuous. Bristles 6 or more . . . 4. *glauca.*
      Pan. interrupted or subpyramidal. Bristles 1 on pedicel and usually 3–4 below pedicel . . . . . 5. *intermedia.*
  B. Bristles retrorsely barbellate . . . . . 6. *verticillata.*

1. S. plicata, *T. Cooke.* Syn. Panicum plicatum, *Lamk.*

A striking grass 2–5 ft. high erect from a short woody stock. Leaves plicate, the lower elliptic-oblong finely acuminate, 15″ by 2·5″ or larger, upper gradually more linear ; sheaths very striate, ligule of stiff hairs. Panicle large very compound narrowly pyramidal erect 6–12″ with long lower strict branches with wavy scabrid rhachides, ultimate branchlets ending in a rigid awn-like continuation of the rhachis beneath the spikelet. Spikelets alternate subsessile or shortly pedicelled ·12–·15″ long glabrous or nearly so, often open at the tip. Gl. i ·05–·06″ broadly oblong-ovate obtuse, 3- or faintly 5-nerved ; ii elliptic acute or mucronulate 5-nerved ·1″ ; iii longest ovate acute and mucronate 5-nerved with a short oblong palea : iv subequal narrow-elliptic very acute, minutely trabeculate (at least when unripe) finally polished dark grey or brown.

Moist valleys in the hill forests, not common. Singbhum! Hazaribagh (on Parasnath)! Ranchi and Palamau (at Neterhat, 3000 ft.)! Mayurbhanj, above 3000 ft.! Fl., Fr. Sept.–Dec. Perennial.

There are many forms. I have only described the Chota Nagpur one. Leaf-sheaths appressed-hairy at the nodes and ciliate above. The leaves resemble those of a *Curculigo* or young Palm and wave in apparently still air.

* Indeed they are so variable in respect of the hairs that the character appears to me useless for separating the species.

2. **S. rhachitricha,** *T. Cooke.* Syn. Panicum rhachitrichum, *Hochst.*

A tufted erect leafy grass 8–18″ high, stems with pubescent nodes. Leaves lanceolate-linear to lanceolate, slightly or scarcely plicate. 6–8″ by 1–1·3″ flaccid glabrous or sparsely hairy, base rounded. Spikelets ·1″ elllpsoid, green-nerved, membranous, on the spiciform erecto-patent or spreading slender branches of a subpyramidal panicle 2–6″ long. Bristles supporting the spikelets solitary, twice as long as the spkt. Gl. i 5-nerved (1–3-nerved, *F.B.I.*) minute orbicular membranous; ii 7-nerved (5–6-nerved, *F.B.I.*) obtuse; iii 5–7-nerved = ii, with a minute palea; iv ellipsoid white transversely rugulose.

Ranchi, rare, *Clarke*! Fl. Oct,

Leaf-margins and mouth of sheath villous. Branches of panicle very slender flexuous, pilose as are the pedicels. Spkts. 1-2-seriate secund, more or less imbricate, dorsally compressed.

3. **S. italica,** *Beauv.* Kangni, kangu, *H.*; Marang kukru, Haraba, *K.*; Erba, *S.*; Tangun, *Or.*; Kango (Bonai); Arga (Khondmals); The Italian Millet.

An erect tufted annual 2–5 ft. high with linear or lanceolate-linear acuminate leaves ·3–·5″ broad (often broader in specimens from outside our area), sheath densely ciliate on margin and mouth. Panicle cylindrical spiciform dense, often inclined or cernuous, 3–5″ long, ·4″ diam. or more (without the bristles). Spikelets oval, ·08–·1″ long in small clusters on the abbreviated branchlets of the panicle with 2–3 bristles below each pedicel, bristles nearly smooth or microscopically barbellate, ·2–·3″ long, barbs suberect or spreading. Gl. i ovate hyaline, ·03–·04″; iv oval or elliptic or subglobose, concave, hardening, about ·08″–·1 but variable, not rugose but smooth and microscopically cancellate.

Cultivated on high (not rice-) lands. Probably in most districts. Purneah! Monghyr, *Cal. Herb.*! Singbhum, cultivated sparingly! Fl. Aug.–Oct.

Margins of leaf retrorsely hispid (*fide F.B.I.*; they seem to me merely scabrid). Rhachis of panicle very hairy. Gl. ii ovate obtuse or rounded, about ⅔ths iv, 5-nerved; iii hyaline delicately 4-5-nerved, as long as and same shape as iv, but not concave.

The grain is yellow or reddish and is eaten.

4. **S. glauca,** *Beauv.* Bandra, *H.*; Pingi-natchi, *Beng.*; Kukru, *K.*, *S.*

A somewhat tufted grass 1–3·5 ft. high with glabrous stems, narrow flat leaves 6–12″ by ·2–·3″ often with long soft hairs above and villous towards base, ending in a long filiform tip. Panicles narrowly cylindrical spiciform, dense erect usually 2–3·5″ long by ·2–·25″ (without the long bristles). Spikelets ovoid usually about ·08–·09″ long (see var.) with a cluster of 9–12 (6–12, *F.B.I.*) unequal bristles ·15–·25″ long below, bristles barbellate with spreading or erect barbs, often yellow. Gl. i ovate acute under ½ iii 3-nerved; ii about ⅔ iii, broad, 5-nerved orbicular mucronate pale membranous; iii broad-oblong or ovate 3–5-nerved flat with 2-nerved palea; iv shallowly transversely rugose, hardening.

Grassy places and commonly occurring among other crops, self-sown and sometimes cultivated on uplands. Monghyr, *Cal. Herb.*; Gya, *Mokim*; Santal Parg.,

Cal. Herb.; Ranchi, to 3000 ft.! Very common in Singbhum! Manbhum, *Gage, Camp.*! Parasnath, *Cal. Herb.*! Probably all districts of Chota Nagpur. Orissa, *Walsh*! Fl., Fr. Sept.–Oct.

Stems often geniculate at base, grooved and striate above, often pubescent below panicle, sometimes purple. Sheaths glabrous; ligule of stiff hairs. Margins of leaf smooth or scabrous. Rhachis of panicle villous. Often small imperfect spkts. present and sometimes gl. i-iii dark red when mature. Grain pale yellow.

Var. *α.* **macrocarpa,** *F.B.I.*

Spiciform panicles very stout. Ripe gl. iv ·12-·14″ long by ·08-·1″ broad, conspicuously rugose. In the true var. *macrocarpa* Hooker states that gl. "iii and iv are subsimilar in the ripe state forming a subglobose crustaceous sphere ·17″ diam." Bristles up to ·5″. Behar, *Kurz*! In a cultivated form in Ranchi! the gl. iii remains membranous and this scarcely belongs to the variety.

Var. *β.* **parviflora,** *Munro* (*F.B.I.*) ?

A small form about 1 ft. high. L. 3-4″ by ·25″, margins red, slightly scabrid, sheaths compressed. Spike almost simple ·6-1·5″ only. Bristles about 10, purple. Rhachis of panicle white-pubescent. Spkts. ovoid ·1″. Gl. iv less strongly rugose, transversely lineate with fine ridges.

Ranchi!

Var. *β* **parviflora,** *Munro MSS.*

The spikes are very short, only ·2-·3″ long with a few grains at the base nearly white in colour.

Monghyr Hills, *Kurz*! Gya, *Mokim*! Santal Parg., *Nusker*!

5. **S. intermedia,** *Roem. & Sch.*

A weak flaccid grass from a few inches high to 2·5 ft. and with leaves from narrowly linear under ·1″ to ·5″ broad and lanceolate-linear. Panicles with flexuous rhachis tapering spiciform and interrupted, or with branches up to 1″ long below and subpyramidal. Rhachis of panicle angular scabrid (not villose). Bristles flexuose barbellate with suberect barbs. Spikelets ·08″ long broadly ovoid. Gl. i suborbicular hyaline ·03–·04″, 3-nerved, sometimes apiculate; ii orbicular, ·04″ concave almost truncate and apiculate, distinctly 5-nerved; iii ovate, membranous, as long as iv which is clasped by its margins, often apiculate; iv brown transversely rugulose broadly-oblong or ovate sometimes slightly ridged on the very convex back, often apiculate, its palea smoother fitting its open side.

Gya, *Mokim*! Santal Parg., *Nusker*! Ranchi, *Wood*! Singbhum, grassy places in the rains! Puri, *Walsh*! Fl., Fr. r.s.–Oct.

Leaves usually sparsely hairy, especially with long hairs towards base; sheath ciliate above; ligule hairy. Bristles usually one on the pedicel and 3-4 below it.

6. **S. verticillata,** *Beauv.* Bir-kauni, *S.*

Stature and habit similar to *S. intermedia*, sometimes dwarf and much tufted with small narrow leaves, at other times 3 ft. high with leaves 10″ by ·9″ broad. Panicles usually more cylindrical but tapering, somewhat interrupted with the spikelets appearing sub-verticillate but frequently dense. Always easily recognisable from the long bristles being retrorsely hispid (the barbs reflexed). Glume iv more finely rugulose or only dotted.

Gya, *Mokim*! Patna (*Wall.* 8642 *b*)! Santal Parg., *Mokim*! Monghyr (*Wall.* 8642 *c*), *Ham.*! Hazaribagh, *Wood*! Manbhum, common, *Campbell*! Orissa, *Walsh*! Fl., Fr. Sept.-Oct., also April–June.

Hairiness of leaves and sheaths as in *intermedia*. Rhachis of panicle very shortly pubescent. Spkts. ·08″ long, very similar to those of *intermedia* but paler, glumes usually less apiculate and gl. iv less rugose.

41. SACCIOLEPIS, *Nash.*

Perennial, more rarely annual with linear or convolute and filiform leaves. Spikelets often deep purple on short filiform pedicels in contracted spiciform panicles with a stout fluted rhachis formed of the main rhachis and its adnate branches (very rarely in lax panicles and not in our area), more or less gibbous (very gibbous when panicle is loose), oblong ovate-oblong elliptic or lanceolate, subterete or slightly compressed, usually somewhat turgid, articulate on the pedicels. Gl. i shortest, sometimes scale-like; ii very concave with a curved or basally gibbous back, mostly 7–9-nerved, rarely 5- or up to 13-nerved; iii similar and subequal but less convex, palea narrow, hyaline or rudimentary; iv oblong, very convex ultimately coriaceous or crustaceous with firm narrowly involute margins, palea almost as long, embraced by the glume all round, similar in texture, 2-nerved. Grain tightly enclosed, elliptic with almost flat back and convex face.

A. Gl. i 3-nerved. Spikelets mostly ·1″ or less:—
Spikes ·4–2″ long. Spkts. lanceolate-ovoid, hispid, ·08–·1″ . 1. *indica.*
Spikes 2–9″. Spkts. ovoid, glabrous, ·05–·08″ . . . . 2. *myosuroides.*
B. Gl. i 5-nerved:—
Spikes 6–10″ rigid. Spkts. lanceolate, ·12–·18″ . . . . 3. *interrupta.*

1. **S. indica,** *comb. nov.* Syn. Panicum indicum, *L.*

A slender grass 6″–2 ft. high with linear acuminate leaves 2–5″ long up to ·17″ wide, glabrous. Panicle spike-like, green or slightly purplish ·5–1·5″ by ·15–·2″ diam. with crowded ovoid acute or acuminate often curved shortly or hispidly hairy spkts. ·08–·12″ long. Gl. i ovate, one-third to one-half of iii, lanceolate from a broad base, 3-nerved acute; ii usually subcymbiform curved obtuse 7–11-nerved, ·1–·11″; iii broadly ovate obtuse, 9-nerved as long as iii; iv narrowly ellipsoid very acute ·06–·07″ long, white, smooth, polished, sides overlapping margins of the similar palea, base obtuse mucronulate with remains of the rhachilla.

Wet places, Santal Parg., frequent, *Mokim*, etc.! Ranchi, common! Hazaribagh, common (often very small)! Sambalpur, *Cal. Herb.*! Fl., Fr. Sept.–Nov.

I think it is better to confine this species to those specimens with hairy spikelets. The variety *gracile* so far as applied to those specimens from our area have longer more slender spikes and glabrous smaller spikelets, and appear to be better referred to *myosuroides*. Possibly it belongs to *Sacciolepis augusta, Stapf.* Typical *S. indicum* with small weak stems, leaves narrow ·7–1·5″ long and small spikes ·4–·7″ has been collected in Ranchi, Hazaribagh and Sambalpur.

2. **S. myosuroides,** *comb. nov.* Syn. Panicum myosuroides, *Br.*

A very slender glabrous plant with erect stems 1–4 ft. high from a creeping rhizome. Leaves 2–9″ by ·07–·2″ acuminate. Spikes (panicles) 2–9″ long, the longer ones often nodding, only ·1″ broad in flower, ·15″ in fruit, often deep purple. Spikelets oblong-ovoid crowded suberect in flower, more spreading in fruit, ·05–·09″ long, mostly 2-nate. Gl. i half or slightly under half as long as iii, ovate, 3- (–5-) nerved with semi-amplexicaul base, sometimes apiculate; ii as long as spkt. very convex 7–9-nerved, nerves prominent; iii similar, both sometimes minutely apiculate on the obtuse tip; iv

pale or white, ·04–·06″ smooth shining elliptic acute; all quite glabrous.

Frequent in marshes. Behar, *Hope*! Santal Parg.! Ranchi! Singbhum! Manbhum, *Camp.*! Hazaribagh, *Clarke*! Sambalpur, *Griff.*! Orissa, *Walsh*! Fl., Fr. Sept.–Nov.

Whole plant often purple. Stems striate, polished. L. with 5–6 nerves each side of midrib, ligule a membranous rim ·02″ long, sheaths loose, glabrous. Pedicels unequal, half to three-fourths length of spkt., puberulous.

This may be the same species as *indica* grown in more marshy localities, *i. e.* with water right up to December. Small specimens have the spikes as short as 1″.

3. **S. interrupta,** *Stapf.* Syn. Hymenachne interrupta, *Bühse*; Panicum interruptum, *Willd.*

Stem tall 3–5 ft., stout and spongy below, with linear tapering leaves 6–12″ by ·2–·5″ and long narrow spiciform panicles 6–10″ long by ·3″ diam. Spikelets patent or sub-patent ·15–·17″ long, fascicled, very shortly pedicelled narrowly ovoid. Gl. i broadly ovate acute or obtuse, 3–5-nerved, about one-third length of iii; ii ell.-lanceolate acute (obtuse, *F. B. I.*) strongly 7–9-nerved; iii similar and equal with small palea; iv ·11″ long ell.-lanceolate acute (lanceolate acuminate, *F. B. I.*) palea similar, both hardened white in fruit.

In swamps in the damper districts. Purneah! Ranchi, *Clarke*! Puri, *Walsh*! Fl., Fr. Oct.–Nov.

Leaves with rounded or subcordate base, glabrous. Sheath glabrous. Ligule short membranous. Common peduncle of spkts. sometimes so short that the panicle is almost a spike, imperfect spkts. often present.

42. HYMENACHNE, *Beauv.*

Rather stout grasses with broadly linear leaves. Panicles thyrsoid the branches erect appressed with spiciform branchlets and very numerous crowded narrowly lanceolate secund acuminate spikelets articulate on their minute pedicels. Gl. i membranous cuspidate keeled, shortest; ii with sheathing amplexicaul base on the long internode of the rhachilla between ii and iii, prominently 3-nerved, cuspidate or awned; iii longest, lanceolate acuminate passing gradually into the awn, with 3 strong nerves meeting in the base of awn and 2 lateral weaker ones, empty; iv longer than ii, oblong, membranous in flower, scarcely hardened in fruit, smooth, faintly 2-nerved embracing the palea except at the tip, palea similar and as long. Lodicules minute. Stamens 3. Styles free.

1. **H. myurus,** *Beauv.* Syn. Panicum myurus, *H. B. & K.*

A stout grass with a prostrate rooting base and an erect leafy stem 2–4 ft. high. Leaves 8–18″ long by ·4–1″ broad, tapering from the broad cordate base to the acuminate tip, sheaths glabrous or ciliate, ligule short hyaline. Panicle very dense narrow very compound with closely appressed branches; up to 12″ long by 1″ diam. Spikelets variously grouped shortly unequally pedicelled secund on the erect branches of the panicle, ·25″ long (including the awn) narrowly lanceolate. Gl. i narrow from an amplexicaul base aristulate ·06–·08″ (including the cusp), hispidulous on keel and cusp; ii narrowly lanceolate sub-aristate ·16–·18″ hispidulous, 3-nerved; iii narrowly lanceo-

late gradually tapering into the awn as long as spkt., exceeding ii, strongly 3-nerved, hispidulous on nerves ; iv narrow and finely acuminate almost embraced by iii, shorter than ii, about ·14″, enclosing its palea on the edges. Anthers ·05″. Styles distinct.

Marshes. Santal Parg., *Mokim* ! Also Jalpaiguri and probably Purneah. Fr. Oct.-Nov.

Rhachides of partial panicles broadly winged, subsidiary rhachides less winged or margined, margins hispid, branchlets secund. Pedicels 1-3-nate, ·01-·04″ long. Internode of rhachilla between gl. ii and iii ·03-·04″ long.

43. PANICUM, *L.*

(*sensu circumscripto*).

Grasses of various habit and duration. Spikelets symmetrical, articulate on the usually elongated pedicels of a much divided, at least temporarily open, panicle ; branches of panicle free (not adnate into a false spike), orientation of spikelets to axis indefinite. Glumes herbaceous-membranous, i shortest, often minute, very rarely as long as ii ; ii as long as spikelet, rounded on the back, 5–9-nerved ; iii very similar to ii, 5–9-, rarely 3- or 11-nerved, palea subequal or reduced, rarely 0 ; iv subcoriaceous to coriaceous with firm margins, obtuse to subacute, muticous, faintly nerved or not, palea similar in texture tightly embraced by margin of the glume. Lod. 2, broadly cuneate. St. 2. Styles distinct. Grain tightly enclosed by the hardened glume and pale, biconvex to almost plano-convex.

I. Gl. ii 9-11-nerved, or if 7-n. then iii 7-9-n. :—
  A. Gl. iv smooth and polished :—
    1. Spkts. ·14-·17″ long, mostly rostrate :—
      Leaf-sheaths hirsute with spreading hairs. Panicle usually dense. Cultivated only . . . . . 1. *miliaceum.*
    2. Spikelets ·08-·12″ long (·14″ in *proliferum*, ·3″ in a diseased state of *psilopodium*) :—
      a. Spikelets not gaping :—
        i. Annual, not stoloniferous. Gl. i 5-nerved :—
          † Stems slender. Leaves linear :—
            Leaves without long tapering upper half. Panicles quickly effuse. Gl. iv ·07″. Wild only . . . . . 2. *psilopodium.*
            Leaves narrow tapering from the base or with tapering upper half. Panicle contracted, nodding. Gl. iv ·08-·1″. Cultivated . . 3. *miliare.*
          †† Stems up to ·3″ diam. at base. L. lanceolate-linear with subcordate base :—
            Panicles sub-thyrsiform. Spkts. ·08-·09″ . . 4. *cæsium.*
        ii. Perennial. Stems below creeping or stoloniferous :—
          Spkts. ·1-·11″. Pedicels glabrous with small cupular tips . . . . . 5. *repens.*
          Spkts. ·12-·14″. Ped. angular scabrid, tips clavellate truncate . . . . . 6. *proliferum.*
      b. Spikelets gaping :—
        Panicle open. Spkts. ·12″. Gl. i 4-5-nerved ; ii cuspidate . . . . . 7. *trypheron.*
  B. Gl. iv finely rugulose :—
    Spkts. ·12-·15″ long. Very large perennial. Cultivated . 8. *maximum.*
II. Gl. ii 5-nerved, or if 7-n. then iii 5-nerved :—
  A. Panicle very effuse lax with capillary branches and pedicels :—
    Spkts. ·07-·1″. Height 3-4 ft. L. lanceolate . . . 9. *montanum.*
    Spkts. ·05-·06″. Height 2-15″. L. linear . . . . 10. *humile.*
  B. Spikelets fascicled subsecund sessile or shortly pedicelled 11. *auritum.*

1. **P. miliaceum,** *L.* China, *H.*, *Beng.*; Marha (the boiled and parched grain); Common Millet.

Tufted 1–4 ft. high with erect or ascending terete usually only 4–5-noded simple or sparingly branched stems, softly hirsute below the nodes and leaf-sheaths with copious spreading tubercle-based hairs. Leaves 4–12″ by ·25–·8″ linear, usually glabrous except the often ciliate lower margins, sometimes sparsely hairy. Spikelets rostrate ·14″ or with the cusp ·16–·17″ long, glabrous, in lax or (in cultivation) often very dense or thyrsiform cernuous inclined or rarely erect panicles often 8″ long by 2″ broad. Gl. i large, broad-ovate, ½–⅔rds iii, 5-nerved; ii largest rostrate or sometimes only apiculate, convex, 11-nerved; iii similar or less beaked, empty, paleate; iv oval very convex subacute usually deep yellow with pale nerve lines but various in coloration, crustaceous, smooth and shining, ·08–·12″ long, palea similar with 2 nerve lines.

Cultivated in Champaran, Balasore and Cuttack. Cultivated and apparently feral in Santal Parg.! Probably cultivated to some extent in all districts, but rare in Chota Nagpur. Fl., Fr. c.s. Annual.

Usually a much larger stouter plant than *P. miliare*, but some specimens from the Santal Parg. are very slender with very lax inflorescence.

Grain wholesome. The plant is a good fodder.

2. **P. psilopodium,** *Trin.*

A tufted grass with erect or quickly ascending stems, 8–20″ high. Leaves rather broadly linear, acute or somewhat acuminate, 3–6″ by ·15–·3″ glabrous or with few short spreading hairs towards base, rarely thinly hairy all over; sheaths often with spreading hairs which leave minute raised dots after falling, more usually glabrous loose striate; ligule of hairs. Panicle spreading, 2–5″, with very capillary branches and slender pedicels which are often ·4″ long. Spikelets narrowly elliptic ·08–·1″ rarely ·12″ long (but see monstrous form below) with abruptly acute tip. Gl. i very broadly ovate acute, about ⅓rd spikelet, base amplexicaul but not overlapping itself in front, 5-nerved; ii oblong-ovate as long as spkt. minutely cuspidate, 9- (11-) nerved; iii similar with delicate oblong margined palea; iv narrow-ellipsoid acute, ·07″ very smooth and polished as is its palea.

Patna (*Wall.* No. 8712 *d*), *Ham.*! Singbhum, in rice-fields and waste land! Manbhum (on the Tundi Hills), *Camp.* (No. 42)! Hazaribagh (called var. **coloratum**) with purple spkts., *Clarke*! Fl., Fr. July–Nov. Annual.

An interesting monstrous form, due to insect-puncture, occurs of this grass, which is rather common. In it the spikelets are ·3″ long, gl. i ·08″ ovate-oblong, amplexicaul, 5-nerved very herbaceous; ii ·15″ ovate, 9–11-nerved, only half as long as the spkt.; iii ovate, ·2″ long, cuspidulate, up to 14-nerved, elliptic palea half as long, the 2 marginal nerves puberulous; iv ·25″ long, broadly ovate, slightly cuspidulate, 15-nerved, its palea is glume-like very boat-shaped, ·22″ long, 9-nerved obtuse, the ovary is apparently occupied by a pupa. The rhachilla is very stout and it and the base of gl. iv are bearded. Neither iv nor its palea are at all hardened.

3. **P. miliare,** *Lamk.* Gondula, *Beng.*; Gundli, *K.S.*; Mota Gundli (the cultivated form in Ranchi), *Vern.*; Pani Kuhuri (Khondmals).

Usually a slender grass 1–3 ft. high but sometimes geniculate and stout below with the stem attaining ·3″ diam. Leaves linear 6″–2 ft.

long, gradually tapering from a broad base, usually under ·5″ but up to 1″ broad in some cultivated forms, glabrous or finely hairy, sheaths glabrous. Panicles very compound, contracted or thyrsiform and often nodding, 4–10″ long (without the subsidiary axillary panicles which are often developed). Spikelets suddenly acute or slightly cuspidate ·08–·12″ long, mostly paired on unequal pedicels but often solitary at the ends of the branchlets, lanceolar in flower, elliptic or broadly elliptic in fruit. Gl. i very broad amplexicaul, subtruncate then suddenly acute, or scarcely acute, about one-third spikelet, very thin; ii elliptic obtuse (when unfolded, sometimes appearing cuspidate or mucronulate *in situ*), 9-nerved; iii similar; iv narrow-ell. or ell.-oblong ·08–·1″ long, truncate at base minutely apiculate at tip, white or pale brown, or dark brown and more broadly elliptic when ripe.

Cultivated, feral and wild. Western Bengal and Behar, *Kurz*! Santal Parg., *Kurz*! In all districts of Chota Nagpur and very frequently cultivated on non-rice lands (gora and tanr lands). Fl., Fr. Aug.–Oct.

P. miliare is probably the cultivated form of *psilopodium*. But in Chota Nagpur the cultivation is so poor that the two forms would be expected to be indistinguishable. *Prain* (*Bengal Pl.*) gives as the characters of *miliare* "Leaves hairy; cultivated," and of *psilopodium* "Leaves glabrous; wild"; but he has nevertheless named most of the glabrous-leaved forms in the *Calcutta Herb.* as *miliare*, and I have myself noticed whole crops with glabrous leaves, whereas I have collected *psilopodium* with hairy leaves. *Campbell* says "sown on second-class lands at the beginning of the rains. The grain is inferior in quality, and is only cultivated and eaten by the poorer classes." His specimens have also glabrous leaves.

Hooker (in *F.B.I.*) says "*Stapf* thinks that the true *psilopodium* has nearly always glabrous leaves, smaller spikelets and a shorter gl. i," but no dimensions are given and indeed the *F.B.I.* describes gl. i (= ⅔ ii) in *psilopodium* as relatively longer than in *miliare* (gl. i = ⅔ ii)! Although absolutely the leaves of *miliare* are often broader than in *psilopodium*, yet they are relatively narrower and much more attenuate. Moreover the cultivated *miliare* and its feral forms always appear to have more or less contracted panicles in contrast to the shorter, always quickly effuse, panicle of *psilopodium*. The grain of *miliare* is, as would be expected, rather larger, being ·08–·1″ long as compared with ·07″ long in *psilopodium*.

4. **P. cæsium,** *Nees.*

A very stout grass 2–3 ft. high erect with tufted stems ·3″ diam. at base. Leaves lanceolate-linear 6–9″ by ·25–·7″ near the subcordate base, blade soft hairy, sheaths inflated hirsute with often tubercle-based hairs, ligule of hairs. Panicle large 10–18″ long, subthyrsiform with suberect branches, lower fascicled, branches angular, scaberulous. Spikelets elliptic ·08–·09″ long on very long (or lateral short) pedicels. Gl. rather membranous, i = ¼–⅓ iii, ovate, 5-nerved; ii ovate acute 7–9-nerved; iii similar with linear margined palea; iv as long, elliptic-ovate obtuse pale smooth and polished.

Sant. Parg. (*Wall.* 8744, Rajmahal)! Fl. Aug. Annual.

5. **P. repens,** *L.* Da-gundli, *K.*; Pani-dal, *Or.*

Stem creeping and ascending stoloniferous, 2–5 ft. high, many-noded, clothed below with loose very striate leaf-sheaths which are hairy at the mouth. Barren shoots closely distichously leafy. Leaves linear-lanceolate to linear, those on barren shoots spreading 1–3″ flat, others usually involute, 2–12″ long glabrous or hairy on upper surface, base rounded ciliate as is the top of the sheaths, ligule obscure ciliate (a narrow coriaceous ring, *J.D.H.*). Panicle much resembling

that of *gundli* contracted or sub-effuse, 3–8″ long. Spikelets mostly paired, unequally shortly pedicelled, ·1–·11″ long, erect, lanceolar, very acute. Pedicels with small cupular tips. Gl. i $\frac{1}{4}$–$\frac{1}{5}$th iii, hyaline or white amplexicaul truncate nerveless or 3-nerved; ii membranous, broadly ovate acuminate 5–7-nerved; iii similar, male or neuter, paleate (or not, *J.D.H.*) 7–9-nerved, palea 2-nerved truncate; iv narrow-elliptic acute ·09″ nerveless, polished, sides embracing the palea.

Aquatic or semi-aquatic, common. Purneah! Santal Parg. (*Wall.* 8710*f*)! Ranchi, *Clarke*! Manbhum, *Camp.*! Singbhum! Puri, sandy tracts, *Walsh*! Fl., Fr. July–Dec.

Said to be a good fodder. It is undoubtedly closely allied to *P. miliare* though placed far from it in the floras. *Stapf* says gl. ii 9-7-nerved.

6. P. proliferum, *Lamk.*

A large grass. Stem creeping or floating at base, rooting at the often black nodes as in the last species, often ·3–·5″ diam., much branched with inflated striate leaf-sheaths, erect for 2–3 ft. Leaves 3–12″ by ·25–·7″ tapering from base to apex, or linear, margins scabridly serrulate. Panicle 3–8″ long with many erecto-patent branches. Spikelets ·12–·14″ long erect lanceolar acuminate on scabrid angled pedicels. Gl. i ·03″ rarely ·04″ long, white, suborbicular; ii lanceolate acuminate 9-nerved; iii similar, paleate or not, male or neuter, occasionally 2-sexual (*F.B.I.* p. 51); iv oblong sub-acuminate ·09″ long, pale brown smooth and polished.

Marshy places and tanks. Sikkim Tarai! and probably Purneah. Monghyr *Mokim*! Santal Parg., *Nasker*, etc.! Sargujah, *Clarke*! Fl., Fr. Aug.–Nov.

Leaves rounded at base, ligule of stiff hairs. Panicle branches 3-quetrous with scabrid angles. Pedicels mostly much longer than the spkts., with clavellate truncate tips.

7. P. trypheron, *Schult.*

A tufted grass, slender upwards, 6″–3 ft. high, usually leafy only near the base. Leaves narrow-lanceolate or linear 2–8″ long, usually copiously hairy on both surfaces with tubercle-based hairs, rarely glabrous. Panicle open but often rather narrow from the branches being short or suberect, up to 9″ long in the larger plants. Spikelets unequally slenderly pedicelled in pairs and single on the branchlets, ·12″ long, at first oblong but soon with open glumes. Gl. i $\frac{1}{2}$–$\frac{2}{3}$rds of iii, base amplexicaul, 4–5-nerved, acuminate or cuspidate; ii inserted some distance above i, elliptic long-acuminate or aristulate, 9-nerved; iii similar but acumen rather shorter, paleate, neuter; iv oblong but rather narrowed to the rounded tip, ·09″ long, polished yellow (variable in breadth and in colouring, from pure white to greenish brown with 3–5 darker dorsal stripes, *J.D.H.*).

Purneah, *Kurz*! Santal Parg. (Rajmahal Hills), *Kurz*! Monghyr, *Mokim*! Ranchi, *Wood*! Hazaribagh, very common! Manbhum, *Camp.*! Bare stony ground. Puri, *N. & C.*! Fl., Fr. Sept.–Nov.

Ligule short, fimbriate or of hairs. The divergent cuspidate glumes make this species easily recognizable.

8. P. maximum, *Jacq.* Syn. P. jumentorum, *Pers.*; Guinea Grass.

A very large coarse tufted perennial 6–10 ft. high usually bearded at the nodes with lower leaves 2–3 ft. long by ·5–1″ gradually narrowed from the small rounded or auricled base to the long filiform tip, sheaths

with villous mouth and ligule of long hairs or with long hairs from behind the short ligule proper; midrib conspicuous white. Panicle 1–2 ft. long, erect, decompound, lower branches whorled from a hairy node and usually hairy, up to 1 ft. long. Spikelets lanceolate oblong ·12–·15″ long, often purplish with very membranous glumes.

Occasionally cultivated and succeeds well in Chota Nagpur. Singbhum! Ranchi, *Wood* (cult.)! Parasnath, *Clarke* (without remark)! Fl. May-Oct. Perennial. Native of Africa.

Gl. i very short rounded almost nerveless, about one-fourth spkt.; ii as long as spkt., 5-nerved; iii similar, 7-nerved with slightly shorter palea; iv pale or white nearly as long as iii, somewhat crustaceous, finely transversely rugose.

It proved a useful fodder in Singbhum and should be more largely cultivated for this purpose. It is easily propagated both by seed and by division of the roots, and can be cut several times annually.

1. P. montanum, *Roxb.*

An erect grass from a short stout upright rootstock with very slender stems 3–4 ft. high, lanceolate leaves 5–6″ by ·7–1″, or rather larger and large terminal very effuse loose panicles 8–18″ by 8–12″ with long 1–3-nate capillary branches and very long capillary pedicels bearing minute spikelets ·08–·1″ long.

Monghyr (*Wall.* 8722*a*), *Ham.*! Common in Chota Nagpur in the forests and also in the open. Ranchi, *Wood*! Manbhum, *Camp.*! Singbhum! Hazaribagh (Parasnath), *Cal. Herb.*! Palamau, ascends to the top of the pats! Also Santal Parg., Rajmahal Hills, *Kurz*! and as it is found too in Jalpaiguri! no doubt in Purneah. Fl., Fr. Aug.–Nov. Perennial.

Stem smooth and hard. L. glabrous or usually shortly hairy and ciliate, base sub-cordate, long-ciliate, sheaths glabrous or usually pubescent and edges ciliate, ligule obscure truncate. Panicle with the axils of the branches often swollen. Gl. i 3-5-nerved, $\frac{1}{3}$–$\frac{2}{3}$rds length of iii ($\frac{1}{4}$ iii, *F.B.I.*); ii and iii subequal, 5-nerved, elliptic, acute or obtuse, epaleate; iv polished brown or grey, ·08″ long, oblong with truncate base and very acute tip.

10. P. humile, *Nees.*

A tufted very slender grass 2–15″ high, much branched at and often flowering close to the base. Leaves linear-lanceolate, tapering from the subcordate base to apex, or nearly linear, 1–6″ long by ·12–·2″, conspicuously (usually 6-) nerved and with rather inflated strongly nerved sheaths. Panicle broad with effuse delicate branches and capillary branchlets, lax flowered. Spikelets very small long-pedicelled, ovoid, ·05–·06″ long, pale or purplish. Gl. i relatively large ·04–·05″, broadly ovate acuminate or minutely mucronate from excurrent midrib, 3-nerved; ii longest ovate-lanceolate, very acuminate or sub-aristulate, 3-nerved; iii nearly as long as ii, ovate-acuminate, 3–5-nerved towards tip, paleate, neuter; iv ·04″ ellipsoid obtuse pale polished.

A very common grass, often found in rice-fields and probably occurring throughout our whole area. Monghyr, *Mokim*! Santal Parg., *Mokim*! Ranchi, *Wood*! Manbhum, *Camp.*, *Clarke*, etc.! Hazaribagh, *Wood*, *Clarke*! Singbhum, common! Orissa, *Walsh*! Fl., Fr. Aug.–Nov.

11. P. auritum, *Presl.*

A tall erect grass with broadly linear leaves 8–14″ by ·7–1·2″, and with very compound panicled inflorescence of numerous small lanceolate spikelets, 8–18″ long, contracted or more or less effuse, much fastigiately branched, branchlets and crowded fascicles of spikelets

subsecund. Gl. i = ½ iii, obtuse or acute 3–5-nerved; ii and iii subequal acute or acuminate 5-nerved; iii neuter with small palea; iv thinly coriaceous, white, as long as iii.

Tarai, near Purneah! Monghyr (at Jamalpur), *Cal. Herb.*! Fl., Fr. July–Nov. L. with broadly cordate base, glabrous or sparsely hairy beneath, sheath glabrous or sparsely hairy with villous mouth, ligule very short. Panicle green with scaberulous rhachis, primary branches 2-5″. Spikelets ·07-·1″, sessile or shortly pedicelled, strongly-nerved, subacute, not membranous as in *P. maximum* which it sometimes somewhat resembles (it is called *P. maximum* in *Wall. Cat.* No. 8715*f*). In one specimen gl. ii is 7-nerved.

44. ECHINOCHLOA, *Beauv.*

Annual or perennial with linear leaves, ligule 0 or a transverse fringe of hairs. Panicles of crowded or loosely arranged secund spiciform racemes with triquetrous rhachis. Spikelets secund on the racemes (or "spikes"), close, 2-nate or clustered, articulate on their short pedicels, ovate to elliptic- or lanceolate-oblong, usually cuspidate or awned, flat or depressed ventrally, the flat side turned away from the axis, dorsally convex. Gl. i much the shortest, more or less amplexicaul and ovate, 3–5-nerved, often mucronate or cuspidate; ii as long as spkt., concave, 5–7-nerved, acute to cuspidate or aristulate; iii as long, depressed dorsally, often cuspidate or aristate, palea nearly equal or reduced, finely 2-keeled; iv ovate to elliptic-oblong, obtuse or apiculate, coriaceous or crustaceous polished, very convex on the back with the back towards the axis, margins involute and embracing the sides but not the tip of the palea, palea similar in length and texture. Grain broad-elliptic.

The following key is based on Stapf's (in *Fl. Trop. Africa*):

I. Wild species:—
- A. Gl. i and iv equally obtuse acute or cuspidulate. Spikes 3–4-ranked, mostly short suberect:—
  - Ligule 0. Gl. i and ii minutely rigidly and appressedly pubescent between the nerves. Annual — 1. *colona*.
- B. Gl. i and iv cuspidate or aristate. Spikes suberect or spreading:—
  - Ligule 0, region of junction of blade and sheath discoloured inside, very finely pubescent or glabrous:—
    - Spkts. ·12″, gl. iii cuspidate or more or less awned. An annual weed . . . . . — 2. *crus-galli*.
  - Ligule a distinct fringe of hairs (at least in lower leaves):—
    - Spkts. ovate-oblong to lanc.-oblong ·17-·25″ long, awn 0-1″ long. Spikes more or less nodding, loosely arranged in a secund panicle. Perennial or occasionally annual and then meagre and slender . . . . . — *stagnina* (pp. 998, 999).

II. Cultivated . . . . . — *frumentacea* (p. 998 *bis*).

1. **E. colona,** *Link.* Syn. Panicum colonum, *L.*; P. cuspidatum, *Roxb.*; Jhari (Khondmals).

A tufted slender grass sometimes only a few inches high but usually ascending to about 2 ft. Leaves up to ·3″ broad, glabrous or scaberulous. Ligule 0. Spikes not crowded but mostly longer than the internodes

of the panicle-rhachis, suberect ·3–·7″ long rarely 1″. Spkts. ·1–·12″ long, almost exactly as in *crus-galli* except that the glumes are never awned but acute or usually shortly cuspidate, glabrous or hispidulous, 3–4-seriate.

Purneah, *Cal. Herb.*! Monghyr, *Mokim*! Sant. Parg., *Nusker*! Chota Nagpur (without dist.), *Wood*! Singbhum, common! Manbhum, in wet rice-fields, *Camp.*! Orissa, *Walsh*! Fl., Fr. July–Nov.

Panicum frumentaceum, *Roxb.*, is perhaps rather a variety of this species* than of *crus-galli*, and is only distinguishable by its very crowded panicles and broad leaves with usually longer incurved spikes.

L. 3-12″ by ·17–·3″, rather flaccid, margins smooth or scaberulous, closely nerved or striate each side of the slender midrib. Panicle 2–5″ long, narrow, its rhachis 3-quetrous above and scabrous on the angles. Spikes erect or somewhat erecto-patent, rhachis often with sparse fine hairs. Gl. i acute or minutely cuspidate, scaberulous; ii ·1–·12″, 5-7-nerved, hirtellous or scabrid, ell.-ovate; iii as long; iv minutely cuspidate or apiculate, polished.

2. **E. crus-galli,** *Beauv.* Syn. Panicum Crus-galli, *L.*; Sama-ghas, *Vern.*

Erect or usually with a creeping and rooting base, often creeping in mud, 1–3 ft. high. Spikelets awned about ·15″ (without the awn), hispid, crowded on the more or less secund spike-like branches of a simple oblong or pyramidal panicle, 3–5-seriate subsessile on the flexuose flattened hispidulous and bristly rhachides which are ·7–1·7″ at base and often decrease in length towards the top of the panicle. Gl. i concave ovate acute or cuspidate 3–5-nerved ·09″ with the cusp, ·08″ if only acute; ii ·14″ without the cusp, very concave, strongly 5-nerved and also with fainter intermediate nerves, sharply shortly cuspidate or aristulate; iii 7-nerved, ·15–·16″ without the awn, back depressed, nerves hispid, paleate, male or neuter, awn ·1–·8″ long; iv ·14″ elliptic-ovate suddenly acute or almost cuspidate, smooth, shining; palea of the same shape, its margins above not embraced by but appressed to the fruiting glume.

In moist ground or sometimes growing in water. Jalpaiguri, common! probably therefore Purneah; Sant. Parg., *Mokim*! Gya, *Mokim*! Singbhum! Manbhum, *Camp*! Orissa, *Walsh*! Fl., Fr. Aug.–Nov.

Stems often ·3″ diam. below, spongy. L. linear flat, often 1 ft. long, ·2–·7″ broad at base, glabrous or somewhat hairy. Ligule 0 or, in var. *stagnina* (*E. stagnina*, *Beauv.*), of stiff hairs. Rhachis of panicle frequently with groups of bristles at insertion of spikes, angular with grooves opposite the spikes. Rhachis of spikes sometimes with long tubercle-based setæ.

Var. **frumentacea,** *J.D.H.*† Syn. Panicum frumentaceum, *Roxb.*; Shama, *Beng.*; Sawan, *H.*; Khir (Champaran, when boiled with milk).

Culms erect, 2–4 ft. Panicle erect; spikes secund, incurved, crowded. Spkts. mostly 3-nate, unequally pedicelled, one at least sessile, awnless. Gls. ii and iii cuspidate or scarcely acuminate.

Monghyr, *Mokim*! Singbhum! Said also to be commonly cultivated in Champaran, Angul and Bonai. Fr. c.s.

This is a cultivated form used for grain and fodder, and in the absence of a distinct awn connects *crus-galli* with *colona*.

The grain is cream-coloured, about ·1″ long, convex-ovoid flat and margined on one face, sometimes slightly ridged down the centre of the convex side.

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* Since writing this I observe that *Stapf* in *Fl. Trop. Africa* states that *P. frumentaceum* is evidently descended from *E. colona*, *Link*.

† See note under *E. colona*.

All our wild specimens have a more or less pronounced fringe of stiff hairs in the place of a ligule, and should therefore according to some authorities be maintained as a separate species (*E. stagnina*).

45. OPLISMENUS, *Beauv.*

Leafy weak grasses creeping below then ascending. Leaves ovate-lanceolate to broadly lanceolate, acuminate, flat, with scaberulous margins, base narrower than the middle, unequal, ligule short with long hairs. Spikelets sessile or subsessile, 1-flowered, solitary or fascicled on a simple spike or on panicled (racemed) secund spikes. Glumes 4. Involute glumes usually subequal, i awned, ii often with a shorter awn; iii longest 5–9-nerved with a very short awn or not, paleate or not; iv 2-sexual, 5–7-nerved, coriaceous hardening in fruit, palea similar. Lodicules 2, minute stamens 3. Grain free within the glume and pale.

Rhachis of spikes without long white hairs. Spkts. over ·1″ with rigid viscid awn to glume i . . . . . 1. *compositus.*
Rhachis of spikes with long white hairs. Spkts. ·1″ or less with capillary minutely barbellate awns . . . . . 2. *Burmanni*

1. **O. compositus,** *Beauv.* Bans-pati, *Vern.*; Kau-guria, *Or.*

Stems creeping and rooting below then ascending and 1–3 ft. high slender glabrous striate. Leaves lanceolate acuminate 2–7″ by ·75–1″, base often ciliate, ligule short membranous ciliate. Panicle with 3-quetrous rhachis 4–8″ long with sub-secund solitary, geminate or clustered distant spikes 1–3″ long. Spkts. 1–2-nate, ·12–·14″ (exc. awn), sometimes one imperfect reduced to an awned glume, generally several hairs or long bristles at their insertion. Gl. i, ·05–·1″ with a red viscous rigid rather stout awn ·15–·4″ long; ii 5 (–7)-nerved shortly awned or not, shorter than iii, iii longest, lanceolate, elliptic 7–9-nerved, mucronate; palea narrow or 0; iv lanceolate to elliptic coriaceous shining. All glumes frequently silky or hispidulous.

In damp shady places, usually sub-gregarious. Rajmahal Hills, *Kurz*! Ranchi, especially on the higher elevations! Palamau, 3000 ft.! Singbhum, near nalas! Hazaribagh, on Parasnath, *Clarke*, etc.! Fl., Fr. Oct.–Dec. Perennial.

There are numerous forms. That in our area has usually leaves 5–6″ long with the sheaths ciliate above and often with long villi at the base of the blade (pubescent beneath in the Parasnath plant). Rhachis shortly hispid-pubescent. Spikes erect or spreading. Spkts. solitary or often with a rudimentary added and frequently with bristles at the base. The awns always glandular.

It is not eaten by cattle and horses also dislike it.

2. **O. Burmanni,** *Beauv.* Same vernacular names as the last.

A very delicate leafy grass diffusely branched with ascending stems 6–18″ long. Leaves ·5–2″ long ovate-lanceolate acuminate, with fine scattered white hairs both sides, sheaths closely ciliate towards the mouth. Peduncle usually very long and slender under the short panicle which has 3–6 secund spikes ·2–·6″ long only, the axes of which are clothed with slender white hairs often exceeding the spkt. Spkts. ·07–·1″ long, secund, 1–2-nate on short pedicels furnished with slender hairs like those on the axis. Gl. i with a capillary, not viscid but minutely scabrid awn ·3–·4″ long, ovate, 3–5-nerved; ii subequal, 5-nerved also awned, awn ·1–·2″ long; iii ·1: with an awn about

half the length of that of ii, 7–9-nerved ; empty : iv subequal, ovate, acute.

Gregarious on shady banks and often carpeting the ground in the forest (as in the Betlah Forest, Palamau). Gaya, *Mokim*! Santal Parg., *Nusker*! Ranchi and Singbhum! Hazaribagh (Parasnath), *Clarke*! Manbhum, *Camp.*, common! Palamau! Puri, *Walsh*! Fl., Fr. Sept.–Nov.

This also is, I believe, not eaten by cattle under ordinary circumstances.

46. PASPALUM, *L.*

Annual or perennial with linear, lanceolate or ovate-lanceolate leaves. Spikelets orbicular to oblong obtuse secund and generally 2-seriate on the flattened, winged or 3-gonous rhachis of solitary digitate or racemose spikes. Glumes 3, i absent, ii membranous as long as the floral glumes (rarely short or obsolete), iii empty similar, iv 2-sexual, chartaceous to sub-coriaceous, hardened in fruit. Palea nearly as large, hardened in fruit. Lodicules 2 connate. St. 3. Styles distinct, stigmas plumose, exserted from near the top. Frt. tightly enclosed in the hardened glume and palea, dorsally subcompressed, the flat side turned away from the rhachis.

1. **P. scrobiculatum,** *L.* Kodo, *H.* ; Khodoa-dhan, *Beng.* ; Garakode, *K.* ; Janhe, *S.* ; Kodus, *Or.*

Stems 2–4 ft. high usually erect or ascending from a creeping rootstock. Glabrous. Lower sheaths inflated and compressed, hairy at the edges and ligule of long hairs hiding the very short membrane. L. up to ·4″ broad, with scabrous margins. Spikes 2–6, usually about 3 distant spreading on an angular almost 2-winged rhachis, their own rhachis being 2–5″ long expanded flat ·07″ broad, scabrid on the edges. Spikelets very shortly pedicelled broadly ellipsoid or orbicular ·1″ long subimbricate in two rows. Gl. ii and iii 3–7-nerved membranous ; iv crustaceous with inflexed margins embracing the edges of the coriaceous palea. Palea with the lower margins broadly inflexed shallowly lobed and embracing the grain, striolate with minute raised dots.

Wild in ravines and glades in Singbhum and Purneah! Santal Parg., *Nusker*! Often cultivated on a small scale and frequently appearing self-sown in other crops in most districts. In the Santal Parg. and Manbhum it is sown about the beginning of the rains on high land and reaped in November. Fl., Fr. Oct.–Nov.

Watt states that the grain requires much care in preparation as it sometimes develops a poisonous principle.

47. PASPALIDIUM, *Stapf.*

Usually tufted and prostrate or branched from a decumbent base, mostly perennial and growing in wet places with linear flat or involute leaves. Ligule a ciliolate rim. Spikelets ovate to ovate-oblong or ovate-lanc., awnless solitary very shortly pedicelled secund on the 3-quetrous sometimes marginate rhachis of slender sessile spiciform racemes, which are secund on a common 3-quetrous rhachis of a panicle to which they are more or less appressed to the alternately hollowed-out flanges of the latter. Gl. i minute to half as long as iv, abaxial ; ii dissimilar longer 5–7-nerved ; iii similar to ii with the inner side-

nerves more distant, subequal with iv, palea if present, slightly shorter with conspicuous inflexed flaps on the lower margins; iv dorsally convex, oblong to ellip., muticous or minutely apiculate, crustaceous with firm involute margins; palea tightly embraced by glume all along the margin, crustaceous; lodic. small; styles distinct. Grain tightly enclosed in the gl. and palea.

A. Leaves mostly obtuse or acuminate from the inrolling of the margins:—
Lower spikes shorter than internodes. Spkts. ·08–·09″ . . 1. *flavidum*.
B. Leaves acuminate:—
Lower spikes as long as or exceeding the internodes. Spkts. ·1–·12″. Gl. ii about ⅓ iv . . . . . 2. *punctatum*.
Lower spikes as long or shorter than internodes, upper crowded. Spkts. ·08″. Gl. ii mostly equals iv . . . . . 3. *geminatum*.

1. **P. flavidum**, *Stapf*. Syn. Panicum flavidum, *Retz*.

A grass of very varying size with usually several decumbent and ascending stems from a few inches long to 3 ft., small forms cæspitose. Leaf sheaths inflated compressed, leaves sub-bifarious linear obtuse or suddenly acute (sometimes described as acuminate but rarely somewhat acuminate or only acuminate when the edges become inrolled). Spikelets ovoid ·08–·09″ long subdistichously secund on the flattened rhachides of very short spikes which are racemosely arranged on the long or short rhachis of a simple panicle and are much shorter than its internodes. In very small specimens there may only be a single terminal spike, in large ones up to 9 or 10 spikes on a rhachis attaining 15″. Spkts. very pale, glabrous awnless. Gl. i ·04–·05″ long suborbicular.

A very common grass on moist or wet ground. Santal Parganas, *Kurz*, etc.! Throughout Chota Nagpur, all districts! Khurda (Puri), *Walsh*! Very common in Bengal and no doubt in Purneah, if not throughout the province in the rainy season. Fr. r.s.–Oct. Annual?

Depauperated states are only 2-3″ with leaves ·5–1″, large states have leaves 10″ by ·4″ glabrous, or margins scabrid. Rhachis of spikes up to ·03″ broad, scabrid on edges. Spkts. sessile. Gl. ii = ⅔ths iv, 7-nerved; iii shorter than iv, convex, sub-orbicular, often shortly cuspidate, 5-nerved; iv more minutely punctulate than in *punctatum* but similar.

2. **P. punctatum**, *Stapf*. Syn. Panicum punctatum, *Burm*.

A very similar grass to *P. flavidum*. Stems 1–3 ft. long with often black nodes (as also occurs in *flavidum*) but leaves always acuminate rarely over ·2″ broad. Inflorescence similar but internodes of panicle shorter and the spikes sometimes as long or longer than the internodes, ·5–1·3″ long by ·1″ wide the rhachis more 3-quetrous with 2-seriate depressions in which the spkts. lie, often produced with a few imperfect spkts. towards tip. Spkts. elliptic very acute ·12: long (·08–·1″ long, *J.D.H.*). Gl. i ·03″ long, truncate, broader than long; ii thin obovate ·06″, 3-nerved; iii elliptic as long as spkt. with inflexed edges and depressed 3-nerved back; iv as long as iii, shortly cuspidate minutely striolate with rows of microscopic dots.

Also in wet places (with lower parts sometimes floating) and perhaps as common as the last. Monghyr, *Mokim*; Gya, *Mokim*; Santal Parg., *Nasker*; Chota Nagpur, *Wood*, *Campbell*, etc.; Fl., Fr. Sept.–Nov. Perennial.

The spongy stems with their sheaths attain ·3″ diam. in the larger plants and

root at the nodes. It is very closely allied to *flavidum* and none of the distinguishing characters are absolute. I would have called them varieties only of the same species.

3. **P. geminatum,** *Stapf.* Syn. Panicum fluitans, *Retz*; Panicum paspaloides, *Pers.*

Habit and appearance of *P. punctatum*; usually floating below and rooting at the nodes with long branched spongy stolons. It is said to differ in the rhachis of the spikes not produced at the tip with a few imperfect terminal spikelets but it is produced into a short point. It differs more markedly in the gl. ii nearly equalling iv and the smooth (or scarcely punctulate) glume iv.

Chilka Lake, in salt water, *Alcock*!

Leaves spreading, linear, obtuse, acute or acuminate, lower sheaths dilated. Spikes erect, ·5–1″ longer than the internodes and appressed to the narrow compressed setulose rhachis. Spkts. under ·07″ long, subglobose, glabrous, subsessile. Gl. i very short white, suborbicular retuse; ii 5-nerved; iii paleate, broadly ovate acute, 5-nerved; iv broadly ovate subacute or obtuse, slightly shorter than iii, shining pale brown when ripe.

48. UROCHLOA, *Beauv.*

Annual or perennial grasses with linear to lanceolate leaves, ligule reduced to a ciliate rim. Spikelets more or less dorso-ventrally compressed, convex dorsally with the convex side towards the axis, closely secund on the 3-quetrous, rarely flat, rhachis of spiciform racemes, which are again racemose on the rhachis of a simple panicle. Spkts. articulate on their pedicels which are solitary or paired or 3–4-together and very short. Racemes spreading and usually several times longer than the internodes of the panicle. Glumes as in *Brachiaria* and *Paspalidium* but glume iv rounded or very obtuse at apex and with an abrupt mucro or aristula.

The separation of this genus from *Brachiaria* appears to me somewhat unsatisfactory as the different orientation of the spikelets, probably due to variable torsion of the pedicels, does not appear constant and of little taxonomic value. In *U. reptans* they are sometimes as much abaxial as adaxial, and in this species also the mucro is not more than an apiculus. Indeed I had placed *reptans* in *Brachiaria* before consulting the *Kew Herbarium*. There is sometimes similar doubt as to the dominant orientation of the spikelet in some *Brachiaria*.

A. Spikelets ·15–·17″ long, Gl. iv aristulate:—
  Annual. Spkts. ovate to ovate-oblong acute turgid; gl. ii 7–11-(mostly 9-) nerved. L. mostly 3–6″ . . . . . 1. *helopus.*
  Perennial. Spkts. lanceolate acuminate. Gl. ii 7-nerved. L. mostly 2–3″ . . . . . 2. *setigera.*
B. Spikelets ·07–·09″. Gl. iv apiculate or nearly muticous . . . 3. *reptans.*

1. **U. helopus,** *Stapf.* Syn. Panicum javanicum, *Poir.*

An annual erect grass 1–2 ft. high or decumbent and rooting at the base, nodes hairy. Leaves large narrowly or linear lanceolate, attaining 8″ by ·7″ or sometimes (*fide F.B.I.*) only 1–5″ by ·3–·7″, with scattered tubercle-based hairs or glabrescent, sheaths hairy. Spkts. ·16″ long elliptic acuminate pubescent 2-seriate alternate on the flattened 3-quetrous 1–2·3″ long rhachides of the 4–10 spreading branches (spikes or contracted racemes) near the top of a simple long-peduncled panicle. Gl. i ovate acute ·04–·05″ long (½ ii, *F.B.I.*)

3-nerved; ii 7–9-nerved sub-acuminate = spkt.; iii similar but with depressed back and 5-nerved; iv pale elliptic with a long mucro or short abrupt awn closely finely dotted or rugulose.

Singbhum! Manbhum (near), *Nusker*! Fl., Fr. r.s.–Oct.

L. minutely wrinkled crenulate along margins when dry, base rounded or amplexicaul, margin with long cilia especially near the base, ligule of stiff hairs. Rhachides of panicle and spikes scaberulous and with few long hairs. Pedicels very short with few long hairs, tip with a saucer-shaped base of glume left after fall of spkt.

2. **U. setigera,** *Stapf.* Syn. Panicum setigerum, *Retz.*

Stems 2–3 ft. slender, prostrate and straggling below with long lower internodes; nodes rooting, tomentose. Leaves 2–3″ or sometimes 6″ by ·9″ ovate lanceolate with long cilia towards the amplexicaul base, margins crenulately wrinkled towards the base. Spikes 3–6 spreading or suberect. Spikelets lanceolate cuspidate-acuminate ·14–·17″ long 2-seriate alternate imbricate glabrous or pubescent the very short pedicels with scattered long setose hairs. Gl. i broadly ovate amplexicaul, 3- or sub-5-nerved; ii 7-, rarely 9-nerved; iii 5-nerved, neuter, palea nearly as large; iv about ·1″ long, finely rugose, aristulate.

Frequent in the districts along our eastern boundary from Maldah! southwards, though no specimen appears yet to have been actually collected within it. Fl. Sept., May (May–Sept.?).

3. **U. reptans,** *Stapf.* Syn. Brachiaria prostrata, *Griseb.*; Panicum prostratum, *Lamk.*; P. reptans, *L.*

A small cæspitose grass with stems 4–15″ long and very short amplexicaul lanceolate cordate leaves ·5–1·5″ long, rarely 2″ by ·6″, with the base and sheaths long-ciliate and frequently white-hairy on both surfaces. Spikes usually few at the top of the panicle-rhachis longer than its internodes, secund suberect ·3–1″ long with slender angular rhachis smooth or hispidulous on the margins. Spkts. ellipsoid with acute tip, ·07–·09″ long, glabrous, unequally pedicelled, pedicels with long (rather caducous) cilia. Gl. i scarcely ·02″ long, broader than long, truncate or retuse with a small apex; ii acute 5–7-nerved; iii strongly 5-nerved, paleate; iv as long as iii, elliptic, acute, dorsally rounded, obtuse and apiculate, thinly coriaceous, minutely transversely rugulose in fruit.

A common weed in grazed fields, etc. Patna (*Wall.* 8734)! Bhagalpur, *King*! Monghyr! Santal Parg., *Nusker*! Gya, *Clarke*! Singbhum! Manbhum! Puri, *Walsh*! Fl., Fr. r.s.–Dec. Annual or perennial.

The cilia are frequently on the common abbreviated peduncle of the spikelets rather than on their pedicels. I had placed this species in *Brachiaria* before consulting the *Kew Herb.*

49. BRACHIARIA, *Griseb.*

(Panicum, Sect. Brachiaria, *F.B.I.* in part, and Sect. Paspaloideæ, *F.B.I.* in part.)

Annual or perennial with linear to lanceolate leaves, ligules reduced to a ciliate or ciliolate rim. Spikelets more or less elliptic or oblong, articulate on their very short 1–2- (rarely more-) nate pedicels, dorso-ventrally compressed, convex on the back, adaxial (with gl. i towards

the axis and the convex side of gl. iv away from the axis) closely appressed to and 2-seriate (sometimes obscurely) on the 3-quetrous or flat rhachis of spiciform racemes, which are subsessile on the rhachis of a simple or somewhat compound (racemes sometimes branched near the base) panicle. Gl. i shortest, usually very small; ii 5–7-nerved; iii resembling ii and subequal but side nerves more towards the margin (unequally spaced), male or neuter, palea with conspicuous inflexed flaps below, rarely absent; iv oblong or elliptic muticous or contracted into an apiculus, crustaceous with involute margins tightly embracing the 2-keeled palea. Lodicules 2. St. 3. Styles distinct. Grain tightly enclosed, more or less flattened on both faces.

Very close to *Brachiaria* and the difference in the orientation of the spikelets not always very clear (see note under *Urochloa* and *U. reptans*).

I. Spikelets minute, ·05–·08″ long, crowded :—
  Pedicels all very short, racemes simple with filiform rhachis on a simple panicle . . . . . 1. *isachne.*
II. Spikelets ·1–·15″ :—
  A. Pedicels very short. Racemes 2-4 simple, spreading . . 2. *distachyum.*
  B. Spkts. solitary and 2-nate, one of each pair with elongated pedicels or all pedicels elongated. Racemes often with a short branch at the base :—
    1. Leaves lanceolate with cordate base ciliate or ciliolate (linear in one form of *ramosa* but then spkts. crowded) :—
      Spkts. mostly densely crowded, spikes suberect close, rhachis often with few fine hairs . . . . . 3. *ramosa.*
      Spkts. remote, spikes few distant without hairs . . 4. *Kurzii.*
    2. Leaves linear, glabrous or minutely pubescent at base :—
      Spkts. remote in lax rather irregular racemes . . . 5. *remota.*

1. **B. isachne,** *Roth.*

A very slender grass with many decumbent and ascending stems 6–18″ long, the nodes and mouth of sheaths bearded. Leaves narrowly lanceolate, lower 1–3·5″ upper often very small, acuminate. Spikelets ·05–·07″ long only, crowded, distichously secund in erect or suberect spikes ·3–·8″ long closely alternately arranged on the angular rhachis of a simple raceme, and longer than its internodes. Rhachis of spikes flattened, villous, as are the spikelets.

Rajmahal (Santal Parg.), *Mokim*! Singbhum, *Clarke*! Fl., Fr. Oct.–Nov.

L. glabrous or softly hairy slightly narrowed to the rounded base. Rhachis of spikes narrower than the spikelet. Spkts. very pale, glumes membranous. i minute, only about ·01″ long, but very broad and embracing the rhachilla; ii elliptic-ovate, silky, 3-nerved, acute, iii = ii, back rather depressed, margins inflexed, 3-nerved, silky; iv ·05″ oval, smooth polished; palea rather concave on the back.

2. **B. distachyum,** *comb. nov.* Syn. Panicum distachyum, *L.*

A slender creeping grass with ascending stems 8–20″ long, glabrous or panicle sparsely hairy. Leaves lanceolate to linear-lanceolate or linear acuminate 2–6″ by ·12–·25″ widest at the rounded or amplexicaul base; sheaths closely ciliate. Spkts. spicately arranged in two (–one) series on the 2–4 spreading flattened branches 1–2·5″-long of a simple panicle-rhachis, elliptic-oblong, glabrous, ·1–·15″ long (mostly about ·12″). Gl. i embracing the spkt. and margins overlapping below, one-third to nearly $\frac{1}{2}$ spkt., 3-nerved, obtuse or subacute;

ii 5–7-nerved; iii acute, 5-nerved paleate or not, palea if present narrow, neuter; iv ellipsoid obtuse or rounded, ·08″ long, brown and minutely transversely lineolate or obscurely rugulose when ripe.

Monghyr (var. **brevifolia**, with leaves ·3-1″ only, ovate-lanceolate), *Mokim*! Santal Parg., *Nusker*! Ranchi, *Wood*, *Gamble*, etc.! Hazaribagh, *Clarke*! Manbhum, *Camp.*! Puri, *Walsh*! Probably throughout the province. Fl., Fr. Sept.–Dec.

3. **B. ramosa**, *comb. nov.* Syn. Panicum ramosum, L.; Mota Gundli, *Sant.*

Stems 1–3 ft. high often from a branched decumbent base, leafy, nodes pubescent. Leaves lanceolate or narrowly lanceolate or sometimes linear amplexicaul 1–5″ long, rarely attaining ·7″ broad, sometimes pubescent, sheaths always finely pubescent on the edges and often with sparse scattered hairs above, ligule a fringe of short hairs. Spikes or racemes erect or suberect 1–2·5″ long few or many in an oblong or pyramidal panicle, rhachides 3-quetrous hispidulous and sometimes with a few long hairs. Spkts. geminate, sessile and pedicelled, glabrous or usually pubescent, elliptic-obovoid ·12–·13″ long, apiculate. Pedicel often with few long hairs. Gl. i one-third to nearly half as long as iii, embracing base of spkt., truncate, with an obtuse tip; ii very membranous = iii, 7-nerved, ell.-obovate apiculate, very convex; iii 5- (–7)-nerved with flat back and narrow palea; iv elliptic apiculate thinly coriaceous, closely minutely trabeculate, becoming minutely transversely rugulose in fruit, sides embracing the pale except towards apex, ·1″ long, hardened. Pale similar but flat.

Monghyr, *Mokim*! Santal Parg., *Kurz*, etc.! Patna, *Ham.* (*Wall.* No 8727 *c*)! Singbhum! Manbhum, "found self-sown with *Panicum miliare*," *Campbell*! Parasnath, *Clarke*! Fl., Fr. May–Dec.

Stature and habit very variable, sometimes only 6″ and very ramose with branches 3-4″ with small leaves. In some Rajmahal specimens the leaves are 5·5″ by ·7″ and racemes branched. I would include both *Kurzii* and *remota* under this species; it varies in the direction of both.

4. **B. Kurzii**, *comb. nov.*

A weak grass, decumbent and rooting below with slender stems 1–2 ft., and short lanceolate leaves 2–3″ by ·3–·7″ acuminate, base cordate ciliate and margins crisped below, sheaths with villose margins. Spikelets ·1–·12″ long lanceolar, submucronate, mostly with very elongate pedicels, the longer up to ·2″ on slender branches. Spikes few, 2–3″ long, very remote, sometimes with a short branch at base, naked or with few hairs.

Parasnath, *J.D.H.*! Annual.

I would call this a variety or growth form of *B. ramosa*. There is little or no difference in the glumes. *Hooker* states that a doubtful specimen from Baidyanath (Santal Parganas) has the narrow leaves of *remota*.

5. **B. remota**, *comb. nov.* Syn. Panicum remotum, *Retz.*

A very slender straggling grass 1–2 ft. much branched with linear or somewhat linear-lanceolate leaves 2–4″ by ·25–·3″ finely acuminate, membranous, glabrous except at extreme base and top and edges of sheath where shortly pubescent. Spikelets ·11–·12″ long very loosely

scattered, solitary or in distant pairs on the lax racemes and sometimes racemes with a short branch below, suberect, the whole approaching in habit a true panicle; main rhachis and rhachides of racemes 3-quetrous with scaberulous margins. Gl. i adaxial, orbicular, ·04–·05″; ii ovate apiculate; iii equals ii, acute or subapiculate, 5-nerved; iv apiculate or mucronulate, elliptic, minutely somewhat transversely rugulose!

Orissa, *Walsh*!

This comes very close in the character of its inflorescence to *B. regularis, Stapf.* The inflorescence is much more irregular than most of the genus, but many specimens of *ramosa* show a similar lax tendency in parts of their inflorescence and the species is scarcely separable from narrow-leaved specimens of the latter or from *Kurzii*. *Dr. Stapf* thinks it is better kept distinct.

50. ERIOCHLOA, *H. B. & K.*

Annual or perennial with flat lanceolate or ovate-lanceolate leaves. Spkts. secund on the spiciform branches of a raceme or panicle, more or less dorsally compressed, lower glume rudimentary forming with the foot of the rhachilla a swollen annular callus at the base of the spkt. which is articulate on the thickened top of the short pedicel. Rhachis of spike 3-quetrous. Gl. ii and iii subequal, membranous; iv shorter hardened and mucronate in fruit. The rest as in *Digitaria*.

1. **E. ramosa,** *O. Kuntz.* Syn. E. polystachya, *H. B. & K.*

A slender erect or ascending grass 1–5 ft. high. Leaves 3–10″ by ·17–·4″ linear, acuminate. Spkts. very pale ·12″ long, broadly lanceolar or ovoid subcuspidate or very acute close erect in very numerous erect or erecto-patent peduncled spikes 2–4″ long, forming a narrow secund compound panicle up to 8″, silky or villous rarely glabrous.

Purneah, *Kurz*! Santal Parg., *Kurz*! Monghyr, *Cal. Herb.*! Patna, *Ham.* (*Wall.* No. 8750 *f*, "*Milium Curar*")! Shahabad, *J.D.H.*! Manbhum (Raniganj and Burdwan), *Nusker*! Orissa, *Walsh*! Fl., Fr. Aug.–Nov.

Stems and leaves glabrous or hairy. Ligule very short. Panicle in some Behar plants only 1–2″ with spikes only ·5″. Rhachides 3-gonous, sometimes nearly glabrous. Gls. ii and iii 3-5-nerved; iv with short awn or cusp 2 mm. long, cusp ·3 mm. The callus forms a distinct thickened node at the top of the ·02–·04″-long puberulous pedicel.

51. DIGITARIA, *Rich.*

Annual or perennial with linear or lanceolate leaves. Spikelets usually 2–3-nate, jointed on the pedicel in digitate or racemose spikes, with a 3-quetrous or flat (winged) rhachis. Glumes 4–3, rarely i quite absent, but usually very small hyaline and not embracing the next; ii membranous 1–5-nerved or nerveless; iii usually larger 5–7-nerved, the nerves close parallel straight and prominent; iv subequal chartaceous or coriaceous usually 3-nerved with a similar subequal 2-nerved palea. Lodicules 2 minute, broadly cuneate. St. 3. Styles distinct, stigmas plumose laterally exserted near the apex of floret. Grain oblong, slightly dorsally compressed, enclosed in the hardened glume and pale, which are generally striolate with longitudinal lines of microscopic dots.

I. Rhachis of spikes winged, over ·02″ broad. Pedicels shorter than the spikelets :—
A. Spkts. ·07–·14″ long, lanceolate . . . . . 1. *sanguinalis*.
B. Spkts. under ·07″ long, elliptic-lanceolate :—
Spkts. glabrous or with fine hairs. Fr. pale or slate-coloured, not shining . . . . . 2. *longiflora*.
Spkts. with short capitate hairs. Fr. shining black . . 3. *Royleana*.
II. Rhachis 3-quetrous under ·01″ broad. Pedicels of some spkts. in each cluster longer than the spkt. . . . . 4. *pedicellaris*.

1. D. sanguinalis, *Scop.* Syn. Paspalum sanguinale. (*F.B.I.*),; D. marginata and others, *Link*.*

A slender grass 18″–3 ft. high, ascending from a geniculate branched base, with linear to linear-lanceolate leaves, mostly 1–5″ long, up to ·3″ wide. Spikes slender 3–10 digitate or shortly spiked, mostly 2–4″ long sometimes 6″ with the rhachis triquetrous or winged. Spikelets imbricate usually 2-nate, sessile and pedicelled, or rarely 3-nate on abbreviated peduncles, lanceolate ·07–·12″ long. Gl. i minute or 0, ii up to two-thirds iii or shorter or also sometimes minute or failing; iii as long as spkt. ell.-oblong acute or acuminate 3-nerved on the flat back and with 1–2-nerves on the incurved margins; iv coriaceous, lanceolate very acute or sub-acuminate, minutely striate with micro. dots, wrapping round the similar pale and flower. Rhachis of spike and pedicels of spkts. scabrid-hispid on margins, and glumes in some varieties densely ciliate.

Throughout the province. Fl., Fr. Sept.–Nov. A very variable grass of which the following forms occur in our area :—

a. **extensa,** *J.D.H.* Syn. P. sanguinale, var. extensum *F.B.I.*; D. pruriens, *Herb. Kew.*

Lower sheaths usually with tubercle-based hairs, sometimes glabrous. L. 2–4″. Spkts. more or less ciliate. Gl. i usually absent, ii half iii or minute, ciliate. iii is scarcely ciliolate in the Monghyr specimens, ii ·02–·025″ only.

Santal Parg., *Kurz*, *Nusker*, etc.! common. Monghyr (*Wall.* 8181 *f*)! Fl., Fr. Oct.

β. **Rottleri,** *J.D.H.*

Usually dwarf under 1 ft., much branched from the base, glabrous or hairy. Spikes 2–5 only, 1–3″ long digitate or nearly so, rhachis with wings 2–3 times broader than the midrib. Spikelets broader. Gl. ii rather shorter and narrower than iv and iii, glabrous or ciliate. Monghyr, *Mokim* (*fide J.D.H.*)!

γ. **commutata,** *J.D.H.* Syn. Panicum commutatum, *Nees*; D. marginata var. Linkii, *Stapf*.

Usually tall, often stout with hairy sheaths, leaves 3–6″ and spikes up to 20, 3–6″ long fastigiate or sub-corymbose, the lower often whorled or fascicled. Rhachis flexuous rather narrowly winged. Spkts. ·12–·14″ by ·03–·04″ broad, rather crowded, shortly pedicelled. Gl. i minute; ii lanceolate rather shorter and narrower than iv; iii with lateral nerves glabrous or pubescent; iv lanceolate acuminate.

Chota Nagpur, *Wood*!

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* NOTE.—As far as I can gather from the arrangement in the Kew Herbarium and from *Dr. Stapf's* notes in the *Fl. Trop. Africa* none of the Indian material is now considered to be true *D. sanguinalis*, Scop. Much of it is placed under *D. marginata*, Link. He calls the var. *commutatum* (*F.B.I.*) var. *Linkii*; var. *ciliaris* var. *fimbriata*. I note that *Link* described his *marginata* from a Brasilian plant but the species is cosmopolitan in the tropics. *D. sanguinalis* occurs in Southern Europe. My descriptions and arrangement maintain the whole plexus under *sanguinalis*.

δ. **cruciata,** *J.D.H.* Syn. Digitaria cruciata, *Nees.*

Spikes several, 2–3″, usually horizontal, rhachis slender narrowly or rather broadly winged, spkts. acute or cuspidately acuminate rather loosely imbricate glabrous, purple or green, gl. ii half iii, ovate-oblong, obtuse 3-nerved; iv ovoid or obovoid turgid cuspidately acuminate.

Parasnath, *C.B.C.*! A mountain form. The species is kept distinct by *Stapf.*

ε. **purpurea,** *forma nova* (perhaps *cruciata* with much smaller gl. ii).

Stems dark purple below, lighter purple above. Lower sheaths with tubercle-based hairs. L. 2–3″ by ·2″, a few long hairs near base, ligule prominent oblique. Spikes 6-12 suberect, shortly racemed, 2–2·5″ long, winged rhachis ·03″ wide (wings broader than keeled centre) scabrid. Spkts. glabrous, gl. i absent; ii minute; iii ·08–·09″ long; iv minutely cuspidate. All glabrous.

Ranchi, at Neterhat, elev. 3000 ft.

ζ. **ciliaris,** *J.D.H.* Syn. Paspalum ciliare, *Retz*; Digitaria ciliaris, var. quadristachya, *Wight*; D. marginata, var. fimbriata (*Stapf* in *Kew Herb.*).

Usually tall. Spikes 2-6, 3-6″ long with slender rhachis winged and ·03–·04″ broad, usually flexuous. Spkts. lanceolate ·12″. Gl. i scale-like; ii nearly as long as iii but narrower, 2–4-nerved and villous, with long spreading villi in the pedicelled spkt.; iii with thin 3-nerved back and inflexed 2-nerved margins which especially in the pedicelled spkt. have two rows of dense spreading villi longer than breadth of glume and often hooked at their tips; iv subacuminate.

Very common. Monghyr, *Mokim*! Santal Parg. (Rajmahal), *Wall.*! Throughout Chota Nagpur in all districts, common! Puri, *Walsh*! No doubt throughout the province.

2. **D. longiflora,** *Pers.* Syn. Paspalum longiflorum, *Retz.*

Stems much tufted, procumbent below and rooting with ascending branches or prostrate. Leaves lanceolate short (in all specimens from our area). Peduncles and rhachis very slender. Spikes 2–many subterminal, 1–3″ or sometimes 4″ long, usually white. Spkts. elliptic-lanceolate ·05–·06″ long, geminate or alternate subsessile and shortly pedicelled, the hairs if any slender crisped. Glume i obsolete, ii as long as iii, with 3 prominent nerves and usually sparsely hairy or shorter or obsolete, iii elliptic about 5-nerved.

Monghyr Hills, *Kurz*! Western Bengal and Bihar, *Kurz*! Santal Parg., *Nusker*! Ranchi, *Gamble*, *Wood*! Manbhum, *Campbell*, etc.! Hazaribagh, *Clarke*! Fl., Fr. July–Dec. Probably annual.

L. sheaths glabrous or somewhat hairy, blade ·5–2″ or (*fide Hooker*) sometimes long and linear, erect or spreading. Rhachis of spikes up to ·03″ wide with scabrid edges. Fruiting glume grey (not shining black as in *Royleanum*).

Hooker states that gl. iv is acuminate; it seems to me only acute.

3. **D. Royleana,** *Prain.* Syn. Paspalum Royleanum, *Nees.*

Erect or shortly decumbent below, 1–3 ft. high with long linear erect leaves 3–6″ long. Peduncle and rhachis very slender. Spikes 2–10 erect or suberect, 1·5″ on small specimens to 4·5″. Spikelets oblong-ellipsoid geminate and shortly pedicelled, ·04–·05″, the hairs short and capitate or clavate. Fruit black and shining.

In the hills. Monghyr, *Ham.* (*Wall.* No. 8752 *b*)! Patna (*Wall.* 8684)! Santal Parganas, *Gamble*, *Mokim*, etc.! Ranchi, *Clarke*! also collected by me in Bilaspur near our western borders in the hills. Fl., Fr. Sept.–Nov.

Sometimes tinged purple. L. up to ·2″ wide, surface often scabrid. Rhachis of spikes flexuous, scabrid. Gl. i absent; ii sometimes reduced to a tuft of hairs, at other times = ⅓ths iii, shortly hairy; iii shortly hairy = iv; Pedicel setose or setulose at tip.

4 **D. pedicellaris,** *Prain.* Syn. Paspalum pedicellare, *Trin.*

Tufted erect branched from the base 6–18″ high with linear acuminate leaves 2–6″ by ·12–·17″. Peduncles slender with 3–10 alternate suberect or spreading filiform spikes 1–4″ long. Rhachis trigonous under ·01″ broad. Spkts. 2–5-nate, ·05–·06″, one or more of each group with pedicels one and a half times as long as the spkt.

Patna (*Wall.* No. 8747 *a*), *Ham.*! Rajmahal Hills, *Kurz*! Singbhum, *Clarke*! Manbhum, *Campbell*! Hazaribagh, *Clarke*! Fl., Fr. Sept.–Nov. Annual.

Sheaths sparsely hairy. Ligule short, scarious. Glumes sometimes slightly hairy. ii and iii subequal 5-nerved, iv pale.

52. ALLOTEROPSIS, *Presl.*

(Axonopus, *F.B.I.* not of *Beauv.*)

Perennial grasses with ovate to linear leaves and 2-fld. spikelets articulate on their pedicels in whorled or digitate spikes. Glumes 4; i shortest, ovate acuminate or cuspidate 3-nerved; ii ovate-lanceolate, awned or acuminate, 5-nerved, fringed with hairs; iii 5 nerved with a very short 2-fid or 2-partite palea; iv as long as ii, coriaceous, narrowed into a straight awn and with coriaceous 2-nerved palea. Lodicules cuneate. Stamens 3, anthers long. Styles distinct. Grain small, suborbicular, free within the hardened glumes.

Leaves ovate to ovate-lanc. Spikes subverticillate at top of stem.
Spkts. ovate . . . . . 1. *cimicina.*
Leaves long linear. Spikes few sub-digitate. Spkts. lanceolar . 2. *semi-alata.*

1. **A. cimicina,** *Stapf.* Syn. Anonopus cimicinus, *F.B.I.*

A hairy grass 1–2 ft. high with numerous ascending stems from the root and ovate or ovate-lanceolate hairy and ciliate leaves ·8–2·5″ long with cordate base and ligule of long hairs. Spikes simple or 2-furcate, 4–8 in a terminal whorl, 2–6″ long. Spikelets dorsally compressed 1–3-nate on short slender pedicels, ovate or lanceolate-ovate, ·1–·14″ long (exc. the slender awn). Gl. ii fringed with dense pink hairs. Gl. iv with a very slender tail or awn ·02–·04″ long.

Monghyr Hills, *Kurz*! Santal Parg.! A common grass in the rainy season in semi-shade in Chota Nagpur. Ranchi! Manbhum, *Camp.*! Singbhum! Fl., Fr. r.s.–Oct.

The hairs are tubercle-based and the grass is a very easily identified one. L. ·8″ wide in well-grown specimens.

2. **A. semi-alata,** *Hitch.* Syn. Axonopus semialatus, *Hook. f.*

An erect grass 2–3 ft. high from a bulbous rootstock which is clothed with densely pilose sheaths. Stem glabrous except at the bearded nodes. Leaves mostly near base of stem linear tapering 3–10″ long by ·3″ wide at base or less, sparsely hairy both sides, sheaths very hairy. Spikes 2–5 digitate 1·5–5·5″ long interrupted, rhachides hairy or villous, 3-angled and channelled. Spkts. lanceolate ·2″ long, mostly 3–4-nate (1–2-nate, *F.B.I.*) with unequal pedicels up to ·25″ long.

Chota Nagpur, above 2000 ft. A very common grass both in the open and in the forest at about 3000 ft. Ranchi and Palamau! Parasnath, *Clarke*! Fl., Fr. April.–July.

Base of stems often over ·5″ diam. with the sheaths. Gl. i ·1″ purplish, scarious 3-nerved, ovate, 2-toothed and with midrib excurrent; ii and iii subequal. ii

elliptic strongly 5-nerved and ciliate, cuspidate; iii lanceolate, 3-nerved, somewhat crustaceous with hyaline unequally 5-toothed palea, 2 lodicules and 3 stamens; iv lanceolate glabrous coriaceous 5-nerved with slender awn ·04″, 2-sexual with hyaline 2-nerved palea and broadly cuneate lodicules.

The toothed palea may not be constant. It is not noticed by *Hooker*.

53. SPINIFEX, *L.*

Stout rigid bushy polygamo-diœcious xerophytic grasses with long rigid involute leaves. Inflorescence in large subglobose umbels or heads. Male spkts. large 2-fld. subsessile articulate on rigid peduncled spikes, which are collected into umbels surrounded by spathaceous leafy bracts; glumes 4, i and ii empty; iii and iv paleate triandrous. Fem. spikelets collected into large globose heads of stellately spreading long rigid subulate bracts and barren prolongations of the rhachides together with shorter flattened-subulate bracts; each spikelet solitary and articulate at the very base of the rhachis, lanceolar, 2-fld. Glumes i, ii, iii as in the male but mostly larger, iii paleate, empty or 3-androus; iv female or 2-sexual. Lodicules 2, large, nerved. Styles long free or connate at base, stigmas long shortly feathery. Grain free within the hardened glumes.

Natives of sandy shores and deserts.

1. S. squarrosus, *L.* Burkonko, Rabana, *Or.*

A large glaucous fruticose grass forming bushes 2–4 ft. high and broad and with long underground or superficial stolons. Leaves 4–6″ long squarrose, recurved, pungent, margins spinulose-serrulate; sheaths often imbricate inflated dry striate hirsute at the mouth; ligule hirsute.

Sandy places on the coast. Balasore! Cuttack! Puri! Fl., Fr. r.s.

Male umbels sessile at the angles of a zigzag rhachis with pungent lanceolate bracts ·7–1·2″ long; spikes 2–3″ with the scabrous rhachis produced at the tips into pungent spines resembling those of the female but short. Spikelets ·4″ long, glabrous scaberulous. Gl. i shortest about ·2–·25″ long 7–9-nerved; ii similar but a little longer; iii lanceolate 5-nerved rigidly acuminate or subaristate; iv usually a little longer (in our specimens, *Hooker* says shorter) subaristate or cuspidately acuminate. Fem. spkt. ·4–·45″ long partly sunk in the base of the needle-like rhachis which is supported by distichous bracts, some of which are similar to itself 3–6″ long, others short flatter and 1″ long. Glumes and palea all lanceolate-acuminate membranous and subequal, outer puberulous, i 11-nerved; ii 7–9-nerved; iii 5-nerved; iv 5–7-nerved, 2-sexual; palea 2-nerved, lodicules quadrate-oblong 2-nerved. Style with stigmas ·75″ long.

The long stolons (which are not mentioned in the *F.B.I.* or *Beng. Plants*) run for a considerable distance and then give rise to a further clump; they serve, with the grass itself, to fix the sands along which the large globose infrutescence may often be seen bounding along before the wind on its long elastic spines.

54. SACCHARUM, *L.*

Robust very large perennial grasses with flat or convolute leaves, those from the base usually very long. Spikelets 1-fld. small or very small similar or nearly so, 2-nate, sessile and pedicelled on the articulate fragile rhachis of racemes, racemes simply whorled on an elongate common rhachis or panicles large silky much and densely branched, the branches often spreading in flower, erect in bud and fruit. Glumes 4, membranous or outer chartaceous towards the base. Gl. i with inflexed margins and usually 2-keeled or with an even

number of nerves; ii 1–5-nerved; iii hyaline awned or not, empty; iv shortest, rarely 0, awned or not; palea hyaline nerveless or 0, lodicules cuneate. Stamens 3. Stigmas laterally exserted. Grain oblong to subglobose.

As remarked by me in *Fl. Ch. Nag.* the awned gl. iv of some *Saccharum* breaks down the only distinction between that genus and *Erianthus*. *Dr. Stapf* has sunk *Erianthus* in *Saccharum* in the *Flora of Tropical Africa* which course is adopted here.

Much interesting information and further details on the plants of this genus will be found in *Hole's* Œcology of some Indian Forest Grasses (*Ind. For. Memoirs*, vol. i, Part I).

I. Awn of gl. iv not or scarcely exserted from spkts. or 0:—
  A. Hairs on callus much exceeding the spkt. Gls. i and ii not dorsally villous:—
    Culms not leafy above, under ·7″ diam. L. under ·8″ in width. Gls. i and ii ciliate . . . . . 1. *spontaneum*.
    Culms densely leafy above, over 1″ diam. L. over 1″ in width. Gls. i and ii glabrous . . . . . 2. *officinarum*.
  B. Hairs on callus of sessile spkt. shorter or not much longer than spkt. Gls. i and ii often dorsally villous:—
    1. Nodes of culm not bearded. Sheaths not hirsute. Gls. i and ii dorsally villous:—
      Foliage not glaucous. Culms densely leafy above. Sessile spkt. shorter than internodes . . . . 3. *arundinaceum*.
      Foliage glaucous. Culms not leafy above. Sessile spkt. longer than internode of rhachis . . . 4. *munja*.
    2. Nodes of culm bearded. Sheaths hirsute. Gls. i and ii not or sparsely villous dorsally . . . . 5. *narenga*.
II. Awns of gl. iv distinctly exserted from the spkt.:—
  Panicles thyrsiform. Spkts. ·13–·16″ long. Awn ·1–·23″ long . . . . . 6. *ravennae*.
  Panicles not thyrsiform. Spkts. ·17–·19″ long. Awn ·3″ . 7. *fastigiatum*.*

1. **S. spontaneum**, *L.* Kans, Khansi, *H.*, *Beng.*; Puyal, *K.*; Kariba, *M.*

A coarse grass 5–7 ft. or attaining 15 ft. along canal-banks, usually glaucous with solid stems, ·1–·5″ diam. (fistular below, *Hole*). Easily recognised by its very narrow leaves frequently with incurved or rolled-up margins, and by the white silvery narrow panicles 1–2 ft. long with the callus hairs many times longer than the small spikelets. Branches of panicle 3–4″, more or less whorled on the silky rhachis and articulate to it. Spikelets very variable in size, ·08–·2″ long. Gl. i lanceolate, basal third becoming hard and polished in fruit, 2-keeled, entire or minutely 2-toothed, ciliate, minutely adpressed-pubescent above; ii broad-lanceolate, subequal, 1-keeled with inflexed long-ciliate margin, sometimes mucronate; iii shorter, ovate-lanceolate, long-ciliate, minutely pubescent above on back; iv minute, hyaline, linear, ciliate (or 0 ?, *Hole* says he has always found it in fresh flowering specimens).

Usually along river-banks and in swampy localities.

Champaran, very common! Monghyr, *Mokim*! Gya, *Mokim*! All districts of Chota Nagpur! No doubt in all districts of the province. Fl., Fr. Aug.–Nov.

Sometimes more or less stoloniferous, at other times tufted. *Hole* points out that although the species varies greatly the differences are not of taxonomic importance. He distinguishes (1) a form of dry sandy soil with culms usually under ·2″ diam., erect and tufted, L. exceedingly narrow sometimes only ·05″ wide; (2) a swamp form, where there is abundance of moisture throughout the year. Culms ·2–·6″ diam., usually decumbent at base and not tufted, L. attaining a width

* Transferred to *Eulalia* at Kew.

of ·7″, callus hairs only 1½-3½ times as long as spkt.; and (3) an intermediate form, the loam form.

Used for thatching and brooms, and the panicle for decorating the hair at the Kol dances. The long callus hairs spread when ripe and waft the seed to immense distances; they may often be observed hanging together in large masses.

2. **S. officinarum,** *L.* Uk, ak, ik, *Vern.* Also Katari (Behar). The Sugar-cane. There are numerous vernacular names for different varieties.

A gigantic grass with the solid leafy stems often 15 ft. high and 1–1·5″ diam.; internodes shining polished yellow or purple. Leaves 3 ft. or more by 2–3″ or more wide, cutting, glaucous beneath. Panicle 2–3 ft. long, rhachis glabrous below the panicle, silky higher up, branches fascicled as in *S. arundinaceum*; ultimate spikes with internodes little longer to one and half times as long as the spikelets, bases of internodes and spikelets with a ring of long villi, longer than the spkt., ends of the internodes and pedicels cupular glabrous. Spikelets sessile and pedicelled exactly similar, ·13–·16″ long, glabrous.

Nowhere known either wild or feral. The sugar-cane is widely cultivated to the north of the Ganges and to a less extent in the Gangetic plain on the south. It is also cultivated in Balasore and other plains districts to a small extent but hardly at all on the central tableland. Our only specimen is *Prain's* from Dalsing Serai, Tirhut, from which the description of the flowers, etc., is drawn.

Mouth of sheath silky inside otherwise glabrous, ligules very short, ciliate. The spikelets have a jointed callus, the lower joint only bearing the long cilia, the upper is glabrous. Gl. i, 2-keeled acuminate; ii equal narrowly cymbiform, sharply acuminate, glabrous in both spikelets or ciliolate towards tip; iii nearly as long, lanceolate, finely acuminate, 3-nerved, sometimes with minute palea; iv: there is a narrowly lanceolate or subulate hyaline ciliate or fimbriate body ·09″ long which is apparently regarded as the fourth glume by *Stapf*, but in our specimens it is on the *same side* as gl. iii and would appear to be the *palea* of gl. iv; on the opposite side is a very short truncate membranous glume or palea wrapping, and not longer than the ovary. These organs require further investigation in more specimens.

3. **S. arundinaceum,** *Retz.* Syn. S. procerum, *Roxb.*; Kagra, *Vern.*; Ekra (when cut); Teng, *Beng.* (fide *Roxburgh*).

A gigantic tufted grass, the leafy stems somewhat with the habit of the sugar-cane, branched, often 15 ft. high, the flowering culms sometimes nearly 30 ft. high and over ·75″ diam.; stem glabrous smooth or slightly rough with very long internodes. Leaves attain 6 ft. and width 2″. Panicle 2–4 ft., pink, white or silvery, diffuse while flowering with smooth glabrous axis, main branches tufted on the axis, tufts alternate or sub-verticillate. Spikelets ·1–·13″ rarely ·15″ long, much shorter than the internodes of the spike. The rest much as in *S. munja*.

In the wet savannah tracts of the Duars spreading westwards into the Sikkim Tarai and Purneah! where, however, it does not attain its full development. Fl., Fr. Nov.–Dec.

Leaves (according to my notes) with rib stout and as broad as the lamina at base, keeled below, villous with long silky hairs above, margins cutting. *Hole*, however, says in basal leaves midrib at base occupies one-third or less of the width of the lamina and he says nothing of its being villous. Upper cauline leaves becoming folded and filiform. Sheaths glabrous, ligule truncate with a ring or tuft of long silky hairs one-quarter to one inch distance from its base. Internodes of spike filiform and often three times as long as spkt. (*Hole* says usually longer, from three-fourths to 1¼ths sessile spkt.), rather sparsely villous

with very long hairs up to ·3″. Callus hairs not dense, as long as spkt. (shorter than or subequal, *Hole*). The glumes are very like those of *S. munja*, but i and ii usually shorter and subequal, iii is very little shorter than i or ii, glabrous in my specimens, iv together with its minute awnlet equals iii in length, sometimes ciliolate.

The culms are used for making the walls of native houses in the Tarai and Duars.

4. **S. munja,** *Roxb.* Syn. S. arundinaceum (part), *F.B.I.*: S. arundinaceum, var. ciliare, *Fl. Ch. Nag.*; S. ciliare, *Anders.*; S. sara, *Roxb.*? Munj, *H.*; Sar (arrow), *S.*; Sara, *Beng.*; Karai, Kandikhar, *Th.*; Ekra (when cut).

A very large tufted grass attaining a height of 18 ft. and diam. ·5″ in favourable situations. Leaves lower 5–7 ft. long by ·75–1″ in the middle or sometimes narrow and only ·15″ wide especially near base, upper cauline tapering to a setiform tip, densely white-villous near the ligule. Panicle 1–3 ft. long, thyrsoid, more or less lanceolate, purple to cream coloured or grey silvery or white in fruit with a glabrous rather angular or sulcate rhachis and sub-verticillate compound branches. Rhachis of spikes, pedicels of spikelets and back of gl. i with long dense silvery hairs 1–2 times as long as the spkt. Spkts. mostly exceeding the internodes of rhachis, ·16–·2″ long, the pedicelled subequal (usually a little shorter). Sessile, gl. i lanceolate, almost cuspidately acuminate, 2-keeled with faint mid-nerve, dorsally villous for from one-third to three-fourths way up; gl. ii more cymbiform glabrous or obscurely hispid on keel. Pedicelled spkt., gl. ii dorsally villous, with villi usually overtopping glume to twice its length.

Usually in the open or along river beds in the forest. Often gregarious. Common in the Northern area, especially on the west in Champaran! Spreading south to Palamau, in Valley of Sone! and Hazaribagh (Koderma Forest)! Also Manbhum, *Campbell*! Fl., Fr. Oct.–Dec.

Foliage glaucous. Pedicel shorter than the spikelet. Callus hairs much shorter than spikelet. Sessile spkt. gl. i with keels scabrid above; ii sometimes subaristulate, usually a little shorter than i; iii chartaceous (hyaline when boiled), about ·13–·14″, lanceolate, acuminate, sometimes minutely aristulate, obscurely ciliate; iv broader, ciliolate, usually aristulate, but awn rarely ·04–·05″ long, glume and awnlet together about = iii in length, ciliolate; palea short broad, wrapping round the linear oblong ·05–·07″ long grain.

The fibre of the upper leaf-sheaths is used for making mats, ropes, etc., and it has been very favourably reported on as a paper material. The plant is, however, very much more abundant in Upper India than in Behar and Orissa.

5. **S. narenga,** *Wall.*

A very large grass 9–12 ft., rarely 15 ft. in our area with a stout horizontal rootstock, stems pubescent above and nodes with a ring of erect long erecto-patent silky hairs, whole plant often reddish. Leaves, lower up to 6 ft. long by 1″ wide, dark-green with white midrib, long-acuminate, narrowed also at base, margins cutting (scabrid), upper surface more or less pubescent and sheaths hirsute or hairy with bulbous-based hairs. Panicle purple, strict, 1–2 ft. long lanceolate or oblong with numerous close short erecto-patent or spreading 1–4-nate branches ·75–3″ long with bearded nodes, lower often compound. Spikelets ·08–·12″ long, both similar, usually longer than or nearly equal to the internode of rhachis or sometimes

only two-thirds as long. Gl. i sparsely villous or not dorsally, villi not overtopping the glume.

In the damper districts or in damp valleys both outside and inside the forest, often in glades in Sal Forest, N. Champaran, frequent on high ground as well as near streams! to Purneah! Singhbum! Ranchi and Palamau, ascending in valleys to 3000 ft.! Manbhum (Tundi Hills), *Camp.*! Hazaribagh (on Parasnath)! Fl., Fr. Aug.–Nov.

Leaf below the panicle often reduced to a brown hirsute sheath with villous margins and setaceous blade, ligule very coriaceous, 2-fid, with very long hairs from the base. Panicle erect stiff. Hairs on rhachis of spikes and callus of spikelets usually red or purple, those on callus shorter or as long as spkt. Gl. i brown shining coriaceous 2-keeled, margins above ciliolate, tip narrowly truncate; ii similar but 1-keeled, equal, obtuse or minutely apiculate, margins ciliate above; iii elliptic, hyaline, equal, very ciliate; iv rather smaller 1-nerved above, fimbriate or ciliate.

Used for rough mats, ceilings, etc., also for arrows.

6. **S. Ravennæ,** *L.* Syn. Erianthus Ravennæ, *Beauv.*

A large tufted grass somewhat resembling *S. munja* with nodes shortly finely bearded and dark green leaves attaining 6 ft. by 1·5″. Sheath hirsute with bulbous-based brittle sub-appressed hairs which are often continued on to the inside of leaf-blade, ligules very short, membranous with dense white hairs. Panicle erect, up to 2 ft. silvery-silky often with a tinge of grey or purple, rhachis glabrous, branches solitary or subverticillate tufted (branched from close to base), lower up to 12″. Spikelets ·13–·16″ long, and most of the pedicels longer than the internodes of the spike. Callus-hairs subequal to spkt. Glumes i and ii subequal, i 2-keeled with the keels more or less excurrent, ii cymbiform, minutely aristulate, margins ciliolate, glabrous or with few hairs dorsally and keel scabrous; iii white hairy; iv with an awn ·1–·23″ long, distinctly exserted from the spikelet, palea glabrous. Pedicelled spkt. similar.

Although common in the Upper Gangetic Plain this grass is not at all frequent in our area though it possibly occurs in Champaran.

7. **S. fastigiatum,** *Steud.* Syn. Erianthus fastigiatus, *Nees*; Eulalia fastigiata,* *Kew Herb.*

A very coarse tufted grass with a superficial resemblance to *S. narenga* than which it is a somewhat smaller grass, usually 5–7 ft. high, and at once distinguishable by its smooth nodes. Leaves, lower 2·5 ft. by ·35″, ending in a long filiform tip, beneath somewhat glaucous, margins minutely serrulate (scabrous), cutting, cauline few 18″ by ·1–·15″ with revolute margins. Panicles shining red 6″–1 ft. erect, inclined or slightly nodding, branches simple or compound at base, in sub-verticils of two or three, 3–4″ long or sometimes up to 7·5″, rhachis laxly villous. Spikelets dense ·17–·19″ long. Gl. i coriaceous minutely 2-cuspidate laxly villous, villi longer than the glume; ii rather shorter subcoriaceous boat-shaped with rounded 1-nerved keel, slightly ciliate towards membranous tip, iii membranous ·1″, adhering to grain; iv small hyaline ·06–·07″ minutely 2-toothed with awn ·3″ long. Grain oblong ·07″.

* *S. fastigiatum* is transferred to *Eulalia* in *Herb. Kew* (probably by *Stapf*). The panicle is somewhat of an intermediate character, but its general appearance in the forest is a *Saccharum* and gl. iv is less deeply 2-fid than most *Eulalia*.

This grass forms one of the principal constituents of the grass lands in the north of Purneah! Fl., Fr. Nov.–Dec.

Attains 10–15 ft. in the neighbouring savannahs of the Duars. Stems brownish polished ·15–·18″ diam. in our area. Sheaths glabrous or very slightly villous on margins at base and inside at base of ligule, ligule very short laciniate or 0. Peduncle villous below the panicle.

55. IMPERATA, *Cyrill.*

Perennial erect grasses with flat leaves and spikelets 1–2-fld., similar, 2-nate and pedicelled, in spiciform or thyrsiform silvery-silky panicles. Upper flower (if two) alone perfect with 4 membranous awnless glumes. Gl. i and ii lanceolate hairy; iii much smaller hyaline glabrous; iv smallest hyaline glabrous with hyaline palea. Lodicules 2, broad, toothed. Stamens 1–2, anthers large, linear. Styles connate at base, stigmas linear. Grain small, oblong, free.

1. I. arundinacea, *Cyrill.* Chero, *K.*, *S.*; Siru, Ulu, *H.*

A common cæspitose coarse grass 1–3 ft. high with erect flat leaves usually short at the time of flowering. Very conspicuous at the end of the hot weather, especially after jungle fires from its silvery-white spiciform panicles 2–6″ long with the dark anthers and stigmas among the hairs; when quite young the panicles are purple.

Usually gregarious, especially on open loamy or clayey ground, and when low-lying, where it may become a considerable pest. Probably in all districts but, like some other common plants, only two specimens from our area exist in the *Cal. Herb.*, one from Manbhum, *Camp.*! the other from Mayurbhanj, *Hooper*! It is common at Neterhat, 3000 ft. on the pats and in many other places! Fl. April–May, but also noted in flower Oct.–Dec.

Rootstock widely creeping and stoloniferous. Stems thickened, pubescent or wooly at base, solid, glabrous above or nodes bearded. Leaves when mature 3–4 ft. long by ·5–·7″ diam., finely acuminate, when young often thinly hairy as are the sheaths; ligule short hairy. Branches of the panicle not breaking up, short crowded appressed. Spkts. unequally pedicelled, ·12–·15″ long, lanceolate, hairs on callus twice as long.

It used to be one of the grasses recommended for paper-making and is sometimes used for thatching. The white stolons are grubbed up by animals. It is scarcely touched by cattle except when first sprouting (when there is scarcely any grass which cattle will not eat).

The following additional notes are from *Hole*:—

Three forms can be distinguished: (1) The depauperate form common on lawns or areas where the grass is continually cut or grazed, with minute almost filiform culms and small leaves. Leaf-insertions usually long bearded. Gl. iv and palea usually glabrous. (2) The ordinary savannah form which usually attains a height of about 3 ft. with leaves up to ·7″ wide. Leaf-insertions bearded or glabrous. Palea and gl. iv ciliate. (3) A robust form found in swamps or marshy soils where there is abundance of moisture more or less throughout the year. This plant attains a height of 9¼ ft. L. up to 1·1″ wide. leaf-insertions glabrous. Palea and gl. iv ciliate; (this is var. *latifolia*, *Hook. f.*).

56. DIMERIA, *Br.*

Slender grasses with narrow leaves and spikelets 1-fld. unilateral alternate (not geminate) on single terminal or usually several racemed or digitate spikes, sessile or pedicelled, rhachis inarticulate. Glumes 4; i linear, rigid; ii broader compressed; iii smaller, hyaline, empty; iv hyaline, 2-sexual, entire or 2-lobed, keeled, 1-nerved, usually awned; awn terminal or from the sinus, capillary, twisted

at or below the middle. Lodicules minute or 0. Stamens 2, filaments short, anthers small. Styles distinct, stigmas short. Grain linear, laterally compressed, free.

Spikelets under ·12″ long. Gl. i glabrous; ii ·02″ wide . . . 1. *ornithopoda.*
Spikelets ·12″ long or over ·12″ long. Gl. i ciliate; ii ·04″ wide . 2. *connivens.*

1. **D. ornithopoda,** *Trin.*

A very slender annual 3–15″ high with many leafy stems from the root. Leaves erect linear ·5–2″, rarely 3″, hairy or ciliate and sheaths with long spreading hairs (or, var. *tenera*) glabrous. Spikes 2, rarely 3, ·5–1·5″ long with slender very flexuous rhachis about ·02″ broad with scaberulous margins. Spikelets about twice as long as joints of rhachis, ·05–·1″, alternate sessile or subsessile ·1″ long with a pencil of hairs at their base. Gl. i linear, a little shorter than the spkt.; ii linear, coriaceous with hyaline margins, as long as spkt., ·02″ wide when folded (they are strongly conduplicate), a few fine hairs on keel near apex; iv about ¾ths ii, very narrow hyaline with terminal awn ·25″ long. Grain linear ·07″ long.

Singbhum, *Clarke*! Hazaribagh, *Clarke*! ascending to top of Parasnath, *Clarke*, etc.! Orissa (Khurda), *Walsh*! Fl., Fr. Sept.–Nov.

The flowers of the Parasnath specimen are exceedingly small (·04″), and *Hackel* called it *minutiflora*. The spkts. of var. *tenera* are ·08″ long.

2. **D. connivens,** *Hack.*

A much tufted grass with leaves chiefly near the base of the very slender ascending stems, 4–10″ high, nodes minutely bearded. Leaves linear with long tubercle-based hairs chiefly on their margins, acuminate, ·5–3″ long, not over ·15″ broad. Spikes erect parallel, 1–1·5″ long, rhachis ·03″ wide. Spkts. ·14–·15″ long excluding the ·3″ long awn, with a minute pencil of hairs at their base. Gl. i slightly shorter than spkt. finely pointed, dorsally ciliate; ii as long as spkt. acuminate, ·04″ broad, prominently keeled and ciliate, with cilia especially long towards the top; iv hyaline 2-fid. Grain ·1″ long linear slightly curved.

Singbhum, *Clarke*! Ranchi, *Clarke*! Sambalpur, common on fire lines! Fl., Fr. Oct.–Dec.

Clarke's Ranchi specimen is the type of *D. connivens.* The leaves are hairy. Rhachis and glumes ciliate. Spkts. ·12″ or a trifle longer. In view of the great variability in size of the spkts. of *ornithopoda* and that on the Singbhum sheet both species appear represented, it is possible that *connivens* is only a form of *ornithopoda.*

57. POGONATHERUM, *Beauv.*

Slender but often tough and wiry grasses with suberect narrow leaves and very slender peduncles with solitary terminal spikes. Spikelets binate, sessile and pedicelled similar except that the pedicelled is smaller and gl. iii sometimes absent. Gl. i narrow-oblong, membranous, tip truncate or rounded with a tuft of hairs; ii subequal or longer with acute or 2-toothed tip and terminal awn; iii hyaline, paleate, male; iv narrow, hyaline, 2-fid, long-awned, palea oblong glabrous. Lodicules 0. Stamens 1–2, anthers long. Stigmas narrow. Grain oblong, free.

1. **P. saccharoideum,** *Beauv.* Bonga-carec', *S.*

A tufted much branched and very leafy elegant grass 1–2 ft. high with firm or almost woody polished slender stems from a perennial rootstock. Leaves 1–2·5″ long only, linear, bearded at the base and margins of sheaths. Spikes ·7–2″ long, terminating all the branches, each spikelet with 2 long fine scaberulous awns ·6–1″ long.

Very common and sub-gregarious along banks overhanging streams and water-courses, and on cool sides of high hills. Purneah, *Kurz*! All districts of Chota Nagpur! ascending to top of Parasnath, *Clarke*, etc.! Puri, *Walsh*! Fl., Fr. all c.s. and h.s.

Nodes of stem glabrous or bearded. L. ·1″ broad or less, acuminate. Rhachis of spikes compressed and pedicel bearded. Sessile spkt. gl. i narrow-oblong, broadest above, faintly 2-4-nerved, tip bearded; ii largest conduplicate ·1″, 1-nerved, keel produced into a long awn, tip densely ciliate; iii sometimes absent; palea of iv broadly ovate-oblong much exceeding the minute ovary. Pedicelled spkt. about two-thirds to three-fourths as long as sessile.

58. EULALIA, *Kunth.*

Perennial with simple erect or ascending stems and leaf blades convolute when young, then flat, usually narrow and gradually passing into the sheath. Spikelets all alike or nearly so (rarely *E. Clarkei*, heterogamous and pedicelled, narrower, and then palea short broad and ciliate), 2-nate, one sessile, the other pedicelled, on the articulate fragile rhachis of 2-nate, digitate or fascicled spikes. Gls. i and ii equal or somewhat unequal, rigidly membranous to coriaceous; i dorsally flattened or shallowly concave (never grooved), more or less 2-keeled with inflexed margins; ii 1–3-nerved, keeled; iii empty, sometimes much reduced, muticous, hyaline; iv very short, 2-lobed (2-toothed only in *fastigiata*)* awned, palea small or 0. Lodicules small, cuneate. Stamens 3. Stigmas linear, laterally exserted. Grain oblong, hilum basal, punctiform.

A. Gls. i and ii subequal, acute or narrowly truncate:—
  Sess. and ped. spkts. dissimilar, ·2″ long . . . . . 1. *Clarkei.*
  Sess. and ped. spkts. similar, ·14–·16″ long . . . . . 2. *argentea.*
B. Gls. i and ii somewhat unequal, ii broadly truncate . . . 3. *Cumingii.*

1. **E. Clarkei,** *Haines.* Syn. Erianthus fastigiatus, *Beng. Pl.* (part).

Nodes densely bearded with long silky hairs. Leaves glabrous (only one on the specimen below the panicle). Panicle of fascicled branches 2·5–4″ long, joints of rhachis and pedicels ·1″ villous, pedicel compressed somewhat channelled and translucent in centre. Spikelets paired, sessile and pedicelled, ·2″ long. Sess. spkt. with short thick callus, dorsally flattened with keel of gl. ii fitting between rhachis and pedicel. Gl. i oblong-lanceolate acute or subacuminate, back distinctly 3-nerved, 2-keeled, margins 1-nerved narrowly inflexed nearly to the base, keels hispid; ii cymbiform aristulate, nerves 3 green, margins very hyaline ciliate; iii lanceolate hyaline subobtuse; iv reduced to the slightly expanded 2-fid ·1″ long base of the ·5″ long microscopically scaberulous awn; palea broadly oblong, very short ·04″ with long cilia on its rounded apex, 2-sexual. Anthers linear ·1″.

* *E. fastigiata, comb. nov.* See *Saccharum.*

Ovary minute. Styles slender free to base. Ped. spkt. gl. i 7–9-nerved as in sessile spkt.; ii 3(–5)-nerved with broadly inflexed hyaline margins, not keeled dorsally; iii and palea as in sessile spikelet; iv 0, lodicules 2 obcuneate, slightly cupular.

Singbhum, elev. 2500 ft. *Clarke* (No. 20551)! Fl. Oct.–Nov.

2. **E. argentea,** *Brongn.* Syn. Pollinia argentea, *Trin.*

A tall slender grass 4–5 ft. high, with flat leaves 1–2 ft. long by ·1–·25″ broad and long and brown shortly racemed or sub-digitate spikes mostly 4–7″ long of sub-secund 3-gonous sessile and pedicelled spikelets ·14–·16″ long, the sessile spkt. being a little longer than the pedicelled. Gl. i linear-oblong, brown, 2-keeled, narrowly truncate, villous, edges inflexed, dorsally flattened; iv with two very slender hyaline lobes, and a long awn, ·6″ long.

Open forest on dry and stony soils. Champaran! Throughout Chota Nagpur, a very common grass in open Sal forests on the hills! Santal Parg.! Sambalpur! Probably in all districts except, perhaps, the moister eastern ones. Fl., Fr. Oct.–Jan. Perennial or perhaps sometimes annual (the rootstock usually has buds, but not always).

Rootstock very short with many stems. Stems and sheaths shining. L. with scattered long soft hairs towards base, tip filiform. Rhachis and pedicels with long white hairs. Gl. ii as long as i, polished keeled acuminate to narrowly truncate tip, margins sparsely ciliate; iii as long lanceolate hyaline; iv ·07″ cleft half way down, narrow, hyaline.

3. **E. Cumingii,** *comb. nov.* Syn. Pollinia Cumingii, *Nees*; Lopud dumbu, *K.*

Stems very slender, many from a stout stoloniferous horizontal rootstock. Leaves short flat narrow. Spikelets sessile and pedicelled ·1″ long in slender, rarely more than 2 brown or yellow-brown spikes 1–3·5″ long, densely covered with brown hairs.

On damp soil, sites of deserted villages, etc. Purneah, *King*! Ranchi, *Clarke*! Singbhum! Hazaribagh, *Clarke*! Fl., Fr. Oct.–Nov.

L. 3–4″ by ·1–·17″, glabrous, ligule short truncate glabrous. Rhachis and pedicels compressed with long brown hairs on the edges. Spikes sometimes 3–4. Spkts. subterete with short blunt hairy callus. Gl. i involute oblong truncate brown-hairy, 2-nerved or nerveless, tip shortly ciliate; ii very slightly longer, broadly truncate less hairy, keel sometimes said to be shortly awned (*F.B.I.*; there hardly is any keel in my specimens); iii absent; iv reduced to a long bent awn (in our specimens) 2–3 times length of spkt., sometimes narrow with subulate lobes (in up-country specimens).

This is a good fodder grass.

59. PULICULUM, *Stapf.*

Closely allied to *Eulalia* but annual. Gl. i as long as ii narrowly truncate or bicuspidate, keels usually villous; ii of sessile spkts. awned; iii or its palea present, palea short broad, ovate.

1. **P. articulata,** *Stapf.* Syn. Eulalia concinna, *Nees*; Pollinia articulata, *Trin.*

An erect tufted grass, sometimes very slender about 4–10″ high or somewhat stouter and up to 3 ft., with filiform leaves and numerous grey-brown spikes 1–2·5″ long in a dense contracted raceme. Stem and leaf-sheaths glabrous. Spikelets sessile and pedicelled or (var.

pedicellata) both equally pedicelled, ·08″ long, rhachis, pedicels and short obtuse callus of spkts. with long silky hairs, rhachis fragile articulate. Gl. i narrow-elliptic-oblong, shining (in nature, appearing hyaline when boiled), with truncate apex but with the two marginal keels shortly produced, dorsally hairy and ciliate; ii subequal, scarcely keeled, slightly hairy, minutely 2-fid at its apex and with a very fine awn longer than itself, nerveless; iii obsolete; iv narrowly oblong 2-fid or 2-toothed (*fide J.D.H.*) and awned, or (in our specimens) reduced to the narrow base of the long twisted awn which is about ·75″ long. Palea lanceolate-oblong hyaline nerveless about ·02–·03″ long.

Common in open ground and open forest. N. Champaran! Very common on half-bare soils of hard clay associated with *Laggera flava*, *Vicoa*, etc., in all districts of Chota Nagpur! Santal Parg.! Probably in other districts, but not collected. Fl., Fr. Oct.–Dec. Annual.

All the Chota Nagpur specimens belong to variety **pedicellata.**

60. POLLINIA, *Trin.*

Annual or perennial often decumbent below. Leaves conspicuously contracted at the base or petioled. Spikelets 2-nate, sessile and pedicelled or both pedicelled, in fragile (easily disarticulate) subdigitate or fascicled usually very hairy spikes. Glumes 4, i membranous or coriaceous, dorsally deeply channelled or concave, truncate or narrowly truncate or 2-toothed with margins narrowly inflexed throughout their length; ii as long, usually laterally compressed, keeled, acute, iii hyaline or 0, ciliate, paleate or not; when glume 0 sometimes palea as long as glume i, male or neuter; iv very short, hyaline, entire 2-fid or 2-auricled or reduced to the dilated base of the long awn, palea small or 0. Lodicules obliquely truncate. St. 3, rarely 2. Stig. as long. Grain free.

Stapf in *Kew Herb.* splits up *Pollinia* into *Pollinia*, *Eulalia*, and *Pulieulum*. Of our original species *P. articulata* is referred to *Pulieulum*, *P. argentea* and *Cumingii* are referred to *Eulalia* and only *ciliata* remains in *Pollinia*.

1. P. ciliata, *Trin.*

A straggling branched grass 2–4 ft. high with rather thickened nodes and firm terete polished internodes. Leaves narrow-lanceolate tapering both ends acuminate 1–4″ by ·2–·5″. Spikes 3–10, 1·5–2·5″ long; joints of rhachis rather stout, somewhat triangular in section and slightly thickened upwards, shorter than the spikelets, bases bearded, laterally ciliate at least in their lower halves. Spikelets sessile and pedicelled. Sessile ·09″ long, callus short blunt bearded. Gl. i flattened dorsally and grooved, oblong, margins inflexed keels scabrid-ciliate and tips ciliate; ii cymbiform acuminate keeled scabrous-ciliate on keel; iii absent; iv minute hyaline with an awn ·4″ long; palea oblong hyaline ·04″.

Singbhum, 2500 ft! Hazaribagh, on Parasnath from 2500 ft. to top. *Clarke*! Fl., Fr. Oct.–Nov.

The pedicelled spkt. usually seems shorter than the sessile, but is otherwise similar. The *F.B.I.* speaks of a palea to iii which I do not find. The anthers are ·08″ long. ii is often aristulate (sometimes with the awn longer than itself, *F.B.I.*) and hispid on the sides; iv is sometimes 2-toothed.

61. POLLINIDIUM, *Stapf.*

(In *Kew Herbarium*, name only.)

Densely tufted perennial with woolly rootstock and basal sheaths. Leaves convolute when old, wiry, mouth of sheaths ciliate. Spikelets binate, sessile and pedicelled, similar, on the articulate fragile compressed, not stout rhachis of digitate or fascicled spikes, fascicles with filiform peduncles on a more or less branched panicle. Callus densely clothed with long brown hairs. Glume i flattened 2–3-dentate, dorsally hairy at base, 5–7-nerved, margins inflexed; ii cymbiform minutely cuspidate, 3–5-nerved, with a slender awn; iii hyaline, sparsely ciliate, elliptic, palea finely ciliate; iv narrow, conduplicate, entire or 2-toothed shortly awned from the tip or minute sinus, palea broad and nearly as long as glume, densely ciliate on the top.

1. **P. angustifolium,** *comb. nov.* Syn. Ischæmum angustifolium, *Hack.*; Pollinia eripoda, *Hance*; Spodiopogoon angustifolium, *Trin.*; Bhabar, Sabai, *H.*; Barchon, *K.*; Bachkom, *S.*; Babuia, Bagali, *Or.*; Panasi, *Khond*; Baib (a trade name).

A much tufted grass 1–2 ft. high, with long drooping wiry leaves when old and clothed with wool at the base of the tuft. Spikes ·7–1·7″ long compound terminating filiform axillary and terminal peduncles, rhachis glabrous but the joints and callus clothed with dense yellow or brown long hairs which almost conceal the spkts. Spikelets ·15–·18″ long (exc. the awns), both similar or only differing in the number of nerves and teeth of gl. i. Gl. i narrow-oblong 5–7-nerved, with 2–3 small sharp teeth or 2–3-cuspidate, more or less hairy on the back, margins narrowly inflexed, brown-ciliate below.

Common and often gregarious in hilly forest, especially in the Central and Southern Areas. In the Northern Area it occurs in the Bettiah and Ramnagar Hills! Rajmahal Hills! Throughout Chota Nagpur, especially common in Singbhum! Puri, chiefly on kankar (Haripur Forest)! Angul, common in Baghmunda, Tikapara and Durgapur forests, especially on lime soils! Mayurbhanj, common! Fl. Feb.–June. Fr. May–July.

Rootstock stout, base of stems (old leaf sheaths) woolly. Very young leaves flat and erect about 1″ broad, old prostrate up to 3 ft. in length, soon becoming concave or involute and harsh, strongly nerved, glabrous except at the ciliate mouth of the sheath; ligule of hairs. Hairs on gl. i chiefly in the lower fourth; ii normally cymbiform cuspidate or shortly awned, scaberulous on the keel above and ciliate on the margins towards tip, dorsally hairy below, faintly 3–5-nerved. I have, however, seen plants with a broadly oblong glume ii lacerate at tip with short awn and 6-nerved from the base! iii hyaline elliptic ·11–·14″ long, minutely sparsely ciliate above, male, with 2 stamens and large finely ciliolate palea; iv narrow conduplicate subequal with very slender microscopically scaberulous awn ·2–·3″ long, palea broad nearly as long as glume, densely ciliate at top, stigmas narrow penicillate, exserted.

Sabai grass is the most important wild grass economically in our area and it is also largely cultivated, especially in the Rajmahal Hills near Sahibganj. It is used locally for strings, ropes and mats (the Baib matting of Calcutta, and it is very largely employed for paper-making. In Singbhum alone the quantity sold for paper yielded 42,000 rupees net revenue annually for a series of years. Fires improve the crop by removing shade. It is easily grown by division of the rootstock or from seed. From seed it yields a crop in about 3 years. Cattle do not eat it.

The species is closely allied to *Pollinia*.

62. ISCHÆMUM, *L.*

Usually perennial with the leaf-blades convolute when young and generally membranous ligules. Spikelets binate, sessile and pedicelled similar or more or less heteromorphous on the articulate fragile compressed rhachis of 2-nate, digitate or fascicled spikes (spiciform racemes). Joints and pedicels flattened or subconcave on the inner side and usually stout. Sessile spkts. dorsally compressed, often rather broad. Glumes 4. Gl. i dorsally flattened or somewhat convex and usually coriaceous below, thinner and distinctly nerved above, truncate or 2-cuspidate (2–3-toothed in *angustifolium*), more or less 2-keeled with inflexed margins: ii as long or longer, narrower and cymbiform, sometimes with a slender awn; iii usually male, membranous with narrow ciliate palea nearly as long as gl.; iv usually 2-sexual and nearly as long as i, cleft into lanceolate lobes with a long awn from the sinus, nerves usually 3 above meeting in the base of the awn, palea nearly as long, linear-lanceolate (broad in *angustifolium*). Ped. spkt. usually more or less reduced, sometimes laterally compressed, often broader male or neuter. Lodicules cuneate-quadrate.

Stapf has separated from *Ischæmum* the new genus *Pollinidium*. This unfortunately affects one of our best-known grasses, *Ischæmum angustifolium*, which is apparently the only species in it. I have retained *angustifolium* therefore in our key to species. It certainly differs in several points from *Ischæmum*, but the multiplication of genera of one or few species appears undesirable, especially where it upsets well-known names. The section Schima is also restored to generic rank. This is altogether desirable and the genus is a good one. It includes *laxum* which I have also retained in the key below for convenience of those who should look for it there.

I. Glume i of sessile spkt. not channelled or depressed along the mesial line. Spikes clustered, only exceptionally solitary:—
  A. Glume i of sessile spkt. with margins only narrowly inflexed throughout:—
    1. Base of stems not woolly. Gl. i not toothed:—
      Gl. i nearly flat dorsally. Perennial . . . . . *aristatum.**
      Gl. i very convex and prominently transversely rugose dorsally. Annual . . . . . 1. *rugosum.*
    2. Base of stems woolly. Gl. i 2-3-toothed at apex and with a tuft of hair dorsally . . . . . *angustifolium.*†
  B. Gl. i with broadly incurved margins below the middle, flat membranous and nerved above:—
    Gl. i with 2 terminal wings; ii with alate keel . . 2. *ciliare.*
    Gl. i 2-keeled, not winged above; ii not winged . . 3. *hirtum.*
II. Gl. i of sessile spkt. deeply depressed along the mesial line. Spikes always solitary . . . . . *laxum.*‡

1. I. rugosum, *Salisb.* Moraro, *S.*

Erect, 1–2 ft. high with branched leafy stems. Leaves narrow 2·5–10″ by ·15–·3″, widest at or little above the middle, sharply acuminate. Spikes 1–2 together yellow scarcely exserted from the leaf axils or long-peduncled, 1–3·5″ long. Spkts. ·15–·18″ long, easily recognised by the broad-oblong gl. i of the sessile spkt. being

* *Aristatum* is said to occur throughout India, but although found in Central Bengal there is at present no specimen from our area.
† See under *Pollinidium*.
‡ See under *Sehima nervosum*.

transversely rugosely ridged or folded for about three-fourths of its length, and the several-nerved membranous remainder.

A common grass chiefly in rice-fields Santal Parg., *Mokim*, etc.! Ranchi, *Wood*! Hazaribagh, *Clarke*! Singbhum! Manbhum, *Camp.*, etc.! Orissa, *Walsh*! Throughout India, *F.B.I.* Fl., Fr. Aug.–Dec. Annual.

Often cæspitose. L. somewhat tapering to the base or broadly subcordate, hairy or usually glabrous, sheaths rather inflated, ligule erect ·1–·2″ long. A villous tuft sometimes occurs at junction of blade and sheath. Internodes of spikes and pedicels very stout, ciliate, callus bearded. Sess. spkt. gl. i sometimes oblique (subdimidiate oblong, *J.D.H.*), rounded at tip; ii as long narrow keeled, 2 lateral nerves faint; iii hyaline; iv 2-fid to below the middle, narrow, with an awn ·5″ long (more or less). Pedicelled spkt. like the sessile or imperfect or smaller and narrower; pedicel one-third to one-half sessile spkt.

2. I. ciliare, *Retz.*

A stout or slender grass 1–2 ft. high, erect or decumbent below or sometimes creeping at base, leafy. Leaves 2–6″ linear, glabrous, pubescent or villous. Spikes ·7–2″ long, rather stout, 2–3 together on a long peduncle. Spikelets ·14–·17″ long or, with the long acumen of gl. ii, up to ·2″; easily recognised by gl. i being very coriaceous with broad inflexed sides below and with 2 membranous wings at the top; ii longest, often ·2″ long (including the acumen but not the short awn), coriaceous convex below, cymbiform, keeled upwards, the keel alate, often shortly awned.

Western Bengal and Behar, *Kurz*! In all districts of Chota Nagpur, common! Puri, *Walsh*! Fl., Fr. Oct.–Dec.

Nodes often bearded with deciduous hairs. Sheaths glabrous or hirsute, ligule short ciliate. Joints of rhachis and pedicels strongly compressed firm, straw-coloured, ciliate on one edge, straight or incurved, about half as long as spkt., tips or lower node of callus bearded.

Three varieties are distinguished by *Hackel*. Our plants all appear to be var. **genuinum** with joints and pedicels diverging at the base, gl. iv of pedicelled spkt. (as well as of sessile spkt.) with slender awn up to ·4″. Form *prorepens* has creeping stem (Ranchi, Manbhum, Puri). Form *malacophyllum* is tall, gl. i broadly winged at tip, keel of ii ciliate (Bihar and Chota Nagpur). Form *villosum* has leaves and sheaths villous (Chota Nagpur).

3. I. hirtum, *Hack.*

An erect or suberect rather stout grass 2–3 ft. high often similar in appearance to *I. ciliare*, stems straw-coloured with nodes bearded (or glabrous, *F.B.I.*). Leaves linear-lanceolate, tapering both ends 3–8″ by ·25–1″ with prominent white costa. Spikes rather stout clustered, 2–20, erect, 1–4″ long (not seen more than 2·5″ in our area). Spikelets ·15–·2″ long. Gl. i boat-shaped but with rounded back below, flattened and 2-keeled above, about 8-nerved including the keels which are slightly excurrent, not at all winged; ii boat-shaped, keel not at all winged, cuspidate or very shortly awned, slightly exceeding i; iii membranous, nearly as long as i, 3-nerved, somewhat boat-shaped, palea similar but flatter; iv as long, hyaline, 2-fid with slender awn from the sinus as long as glume, 3-nerved from the awn downwards, palea as long, lanceolate. Grain ellipsoid, ·08″.

Singbhum, on rocks in streams! Ranchi, *Clarke*! Fl. Oct.

L. (in our specimens hairy) glabrescent (glabrous or sheath sparsely hairy, *F.B.I.*) and sheaths sparsely hairy; ligule short ciliate. Joints and pedicels trigonous subequal about half spkt, bases bearded, rarely a few hairs at tip, callus large bearded. Gl. i subcoriaceous villous above; ii 3–5-nerved glabrous (villous or glabrate, *F.B.I.*).

63. SEHIMA, *Forsk.*

Perennial or annual with leaf-blades narrow, ligule of stiff hairs. Spikelets 2-nate, heterogamous and sometimes heteromorphous, on a solitary terminal articulate spiciform raceme, dorsiventral and laterally compressed, usually slightly curved, joints and pedicels sublinear, parallel. Gl. i deeply grooved, rarely flat, 2-dentate, acutely 2-keeled upwards and winged, margins inflexed; ii cymbiform, keeled upwards, awned; iii hyaline, entire with palea nearly as large; iv 2-fid, awned, palea as long. Pedicelled spkt. flat, gl. i and ii much as in sessile spkt. but not grooved; iii and iv more or less reduced or barren; iv awnless.

1. **S. nervosum.** *Stapf.* Syn. Ischæmum laxum, *Br.*; Andropogon nervosus, *Rottl.*; Raboga, *K.*; Sedwa, *H.*

A perennial grass 3–4 ft. high tufted on a short stout rhizome and with a superficial resemblance to Spear-grass. Stems leafy, straw-coloured when mature, rather slender and constricted at the nodes with the single terminal spikes falling off entirely leaving a truncate end with a short peg-like projection (entirely different from old spear-grass). Leaves flat 6–12″ by ·2–·3″ below the middle, sheaths densely hirsute to glabrous. Spike 3–5″ long with fragile rhachis and 4-ranked compressed spkts. ·2–·25″ long appressed to it. Sessile spkt. with secund awns 1·5–2″ long, pedicelled spkt. awnless. Gl. i narrowly oblong glabrous with margins strongly incurved, 3-ribbed margins, and deeply depressed 1-nerved centre, obtuse or keels produced into 2 short cusps; ii membranous with a delicate awn ·5″ long.

Frequent in hilly forests. Singbhum! Ranchi! Hazaribagh, *Clarke*! Ranigani (near Manbhum)! Angul! Fl. Sept.–Oct. Fr. Nov.

L. with scabrid edges, tapering into a very long filiform tip, not much narrowed towards the base, ligule of hairs. Peduncle pubescent above. Gl. iii hyaline, lanceolate, acute or truncate ciliate, palea as long very acute; iv oblong, about ⅔ iii, deeply 2-fid, awn black below, palea as long. Ped. spkt. Gl. i 2-cuspidate, green or purplish, 5–7-nerved, nerves scabrid; ii 3-nerved, acuminate.

This is one of the best fodder grasses and is eaten by cattle even after the fall of the spikes.

64. APOCOPIS, *Nees.*

Annual or perennial often small grasses with short leaves. Spikelets binate with the upper reduced to its pedicel, or solitary, distichously imbricate on solitary, 2-nate or fascicled articulate spikes, dorsally compressed. Glumes 4. Gl. i very broad, flat and membranous above with truncate ciliate tip, its sides incurved below and coriaceous, many-nerved; ii much narrower sometimes with central keel, always laterally 2-keeled with broadly inflexed margins, tip truncate; iii oblong hyaline, male or neuter with palea as large; iv hyaline, entire 2-lobed or 2-fid awned or aristulate or sometimes reduced to an awn with dilated base; palea much shorter, convolute, truncate, tip ciliolate. Lodicules 0. Stamens 2–3. Styles very short, stigmas long narrow apically exserted. Grain free terete.

Perennial. Gl. iv oblong 2-fid, awn short or 0 . . . . . 1. *Royleanus.*
Annual. Gl. iv linear entire or 2-dentate, awn long . . . . 2. *vaginatus.*

1. **A. Royleanus,** *Nees.*

Stem usually simple erect from a creeping rootstock, 1–2 ft. high with short narrowly lanceolate leaves ·5–2″ (2–4″, *F.B.I.*) long, sheaths and blades with spreading hairs (softly hairy or glabrous, *F.B.I.*). Spikes 1–2, concurrent, ·5–1·5″ long. Spikelets usually sessile only, distichously secund on the rusty-villous rhachis, joints about half spkt. Spkts. ·22″ long (·16″, *F.B.I.*) with short very broad brown-bearded callus. Gl. i adnate to callus at base, rather shorter than ii, very broad (·1″ wide above), dorsally convex below and margins at base somewhat broadly inflexed and partly embracing ii, upper part expanded, tip truncate 2-mucronulate from the excurrent lateral nerves, slightly denticulate between, 7-nerved, 2 lateral each side meeting at base of the mucro, others not reaching tip; iv as long, oblong, hyaline with a broad nerve or discoloration down the centre ending in a minute mucro not longer than the two short lobes of the obtuse ciliolate tip or (*fide F.B.I.*) awn very slender included, or if exserted not twice the length of spikelet.

Purneah, *Kurz*! Fl. May–Sept.

Remarkable from the broad imbricate spikelets from between which the pedicels (if present) project and the densely hairy side of the spikes being turned towards one another. Gl. ii keeled below, flat above; iii very broadly lanc.-oblong obtuse ciliolate convolute and its palea similar; palea of iv broadly oblong hyaline truncate ·12″, microscopically ciliolate at tip.

2. **A. vaginatus,** *Hack.* Syn. A. Wightii, *Nees*, var. *vaginata*, *F.B.I.*

Low and tufted with stems decumbent at base or tall and erect. Leaves 1–3″ glabrous or hairy, tapering both ends, about ·1–·15″ broad in middle; sheaths strongly nerved, hairy (in our specimens, sometimes glabrous ?). Spikes ·5–1·5″ long mostly 2 together, exserted or not from their spathiform sheaths, stout or slender. Spikelets ·16–2″ long alternately awned and awnless, both with a small barren pedicel representing the abortive pedicelled spkt. Awn of awned spikelets ·75–1″ long, hispidly hairy below, glume iv narrowly oblong or linear entire, 1-nerved as long as spikelet or, in the awnless spkts., absent.

Hazaribagh, *Clarke*! Fl. Oct.

The Hazaribagh specimen is var. **vaginata,** *J.D.H.*, with the spikes more or less included in the long spathiform sheaths of the upper leaves, blade often rudimentary. Gl. i densely brown-villous dorsally, broadly oblong, 7-nerved, truncate or rounded tip pectinately ciliate, base surrounding and somewhat adnate to base of gl. ii; ii broadly oblong when unfolded, *in sitâ* narrow, strongly 2-keeled and plicate or depressed between the keels, truncate, ciliolate, villose below; iii hyaline oblong ·12–·14″, glabrous or ciliolate. Palea ·08″ and nearly as broad when unfolded, convolute round the linear tapering ovary, stigmas ·18″ long. Anthers ·05″. Pedicels of abortive spkt. ·05″ bearded. Joints of rhachis about one-third spkt., bearded.

65. LOPHOPOGON, *Hack.*

Small densely tufted perennial grasses with very narrow leaves and very short solitary 2-nate or fascicled spikes at the ends of very slender branches, joints very short, slender, fragile, tips cupular. Spikelets small, homogamous or heterogamous, 1–2 fld., 2–3-nate, one sessile, callus obtusely conical villous. Glumes 4, i and ii charta-

ceous, i oblong, broadly truncate, irregularly 3–4-toothed, 7–8-nerved, dorsally convex; ii longest, lanceolate, narrowed into a straight awn, 3–7-nerved hispidly hairy on the sides and with dorsal tufts of hairs below the middle; iii hyaline, oblong-lanceolate, acute or aristulate, ciliolate, 1-nerved, 1–2-androus or neuter, palea linear 2-nerved; iv nearly as long as iii, fem. or 2-sexual and 2-androus, linear-oblong, 2-fid, lobes setiform and margins hispidulous, awn in the cleft much longer than the glume tortuous; palea quadrate, lobulate, 2-nerved. Lodicules 0. Anthers narrow. Style connate below, stigmas very long.

1. **L. Kingii,** *Hook. f.*

Densely tufted with many fastigiately branched stems 9″–1 ft. high, sometimes subcorymbose above. Leaves narrowly linear, radical 8–9″, gradually smaller upwards and sheathing the peduncles, lower ·05″ broad, nodes, base of leaves and mouth of sheaths softly villous. Peduncles very slender, the branched spike breaking off shortly above the mouth of the sheath, ·5–·7″ long (without the long awns), base of joints and callus all with a barb of brown hairs, obtuse. Spikelets sessile and pedicelled or sometimes a pair of sessile and pedicelled together. Sessile spkt. ·25–·3″ long (without the awns), gl. i ·16–·18″ oblong, 8-nerved below the membranous truncate tip which is 2-cuspidate and obtusely 3-toothed between the cusps; ii 3-nerved keeled, ·25″ or more, sides villous except at base and a dorsal tuft of hairs above base on each nerve, awn slender; iii oblong-lanceolate or linear, if linear then 2-toothed with a short central awn half as long as glume, if oblong-lanceolate then entire, acute aristulate and ciliate; iv ·2″ long with 2 long acuminate scabrid lobes and a central long awn ·6″ long, palea often ·1″ long, very broad.

Monghyr, *Mokim*! Fl. Oct.

Basal spikelets all male in some specimens. Pedicelled spkt. very similar to the sessile but gl. ii 5-7-nerved with the tufts of hair forming a continuous transverse band, awn about as long as spkt. (as in the sessile). The peculiarity of the dimorphous gl. iii appears to occur in both sessile or pedicelled spikelets! Pedicel ·08″ long, bearded.

66. ARTHRAXON, *Beauv.*

Slender grasses with many short lanceolate to ovate deeply cordate leaves and digitate or fascicled or shortly racemed simple or branched spikes. Spikelets solitary, or binate with the pedicelled spikelet reduced, male or neuter or the pedicel only represented. Glumes 4; i not or scarcely embracing the inner; ii subequal or shorter, keeled, 3-nerved, conduplicate embracing the inner; iii smaller hyaline nerveless; iv as long as iii or shortest, lanceolate, keeled, hyaline with a long dorsal or sub-basal awn; palea minute or 0. Lodicules sub-quadrate. Stamens 2–3. Styles short or 0, stigmas long, laterally exserted. Grain linear.

I. Anthers nearly as long as gl. iv. Gl. i pectinately toothed . 1. *lanceolatus.*
II. Anthers not half the length of gl. iv. Gl. i not pectinately toothed :—
Rhachis of spikes glabrous or ciliate. Spikes mostly over ·7″ long. Spkt. ·12–·2″. Gl. i with entire tip . . . . 2. *ciliaris.*
Rhachis of spikes villous. Spikes mostly under ·7″ long. Spkts. ·08–·12″. Gl. i with 2-toothed or 2-aristulate tip . 3. *microphyllus.*

1. **A. lanceolatus,** *Hochst.*

A suberect or sub-scandent branched leafy grass 1–3 ft. high with very firm polished stems and glabrous or very hairy lanceolate (more rarely ovate) leaves ·5–3″ by ·25–1·5″ or sometimes narrowly lanceolate 1–4″ long. Spikes 3–5, ·5–2″ long. Spikelets ·17–·22″ long linear-lanceolate often purple. Gl. i dorsally convex smooth or muriculate acute with hyaline 5–7-nerved tip, marginal nerves with very characteristic pectinate curved teeth, each ending in a hair towards tip. Pedicelled spkt. linear-lanceolate awnless, bearing a male fl.

Manbhum, *Camp.**! Hazaribagh, on Parasnath, 4200 ft. *Clarke*! Fl. Oct.

Our specimens have broadly lanceolate amplexicaul leaves 1–2·5″ long with slightly to densely hairy sheaths, margins of blade pectinately ciliate. Joints of rhachis bearded on one side, transversely truncate at tip. Sessile spkt. gl. ii hyaline keeled, slightly shorter than i, keel sparsely hispid; iii shorter; iv about two-thirds i, acute, hyaline with awn ·4″ long from its base. Ped. spkt. gl. i about ·18″ long, 7-nerved, slightly ciliate towards tip; ii linear-lanceolate, very acute; iii hyaline ·1″ with 2 perfect stamens; iv 0.

2. **A. ciliaris,** *Beauv.*

A small rarely tall and then clambering, usually densely gregarious grass with the lower leafless parts of the slender stems often decumbent, the upper parts with short broad ovate to lanceolate leaves 1–3″ long with cordate base and ciliate margins. Spikelets sessile ·15″ (·1–·2″ *F.B.I.*), green or purple arranged alternately on opposite sides of the flexuous rhachis of 3–5 sub-digitate (shortly racemed) spikes ·7–1·5″ long, which are sometimes branched from the base, or whole inflorescence a single branched spike. Gl. i linear-oblong scabrid or scaberulous or echinate upwards, coriaceous in fruit and cylindrically folded, faintly 7–10-nerved, tip entire; ii keeled, acute or acuminate, keel slightly scabrid with short hairs obscurely 3-nerved, margins broad hyaline embracing the inner glumes. Pedicelled spkt. reduced to the pedicel.

In moist places under shade. Santal Parganahs, Rajmahal Hills, *Kurz*! Ranchi and Palamau, common at 2000 ft. and above! Hazaribagh, common, up to top of Parasnath, *Clarke*, etc.! Singbhum, 2500 ft., *Clarke*! Manbhum, 1000 ft., *Clarke*! Fl., Fr. Oct.–Nov.

Nodes often bearded. L. glabrous or hairy 7–11-nerved, sheath with ciliate margins, ligule of long hairs. Joints of rhachis glabrous or more or less ciliate. Gl. iii about ½ i, oblong hyaline; iv subequals iii with delicate sub-basal awn ·3″ long or less, and linear terete grain about ·1″ long.

3. **A. microphyllus,** *Hochst.*

Closely resembling states of the last species. A delicate diffuse leafy grass with branched filiform stems hairy at the nodes, and short oblong or oblong-lanceolate finely acuminate leaves ·5–1·5″ long glabrous or hairy and ciliate, base amplexicaul cordate. Spikes mostly 2–10 short slender ·3–·7″ rarely 1″ long with villous rhachis at the end of filiform peduncles which are hairy at the end. Spikelets ·08–·1″ rarely ·12″ only; pedicels of upper spikelets not one-third as long as sessile spkt. often with 2 barren glumes. Gl. i of sessile spkt. narrow-linear dorsally scabrid faintly 2–4-nerved, 2-toothed or 2-aristulate at tip, margins inrolled; ii acuminate or aristulate, laterally compressed, the awn sometimes as long as the dorsally scabrid keel,

* *Campbell's* specimen bearing "Flora of Manbhum" label without locality may also be from Parasnath.

sides hyaline; iv sometimes obtusely 2-toothed ·05″, with a delicate awn about ·25″ long. Grain linear.

Gregarious on damp banks and in ravines, very common. Behar, *Hope*! Gya, *Mokim*! Monghyr, *Mokim*! Santal Parg., *Kurz*, etc.! Ranchi, *Wood*, etc.! Parasnath (Hazaribagh), elev. 4000 ft. Anders, etc.! Singbhum! Fl., Fr. Sept.–Dec. Annual.

67. CAPILLIPEDIUM, *Stapf.*

Annual or perennial slender grasses with simple or often copiously branched culms frequently bearded at the nodes. Panicles delicate, usually lax and very compound, the branches capillary often repeatedly 2-furcate (in our species) spikes (or racemes) few-, usually 1–2- (very rarely up to 8-) noded, ending in one sessile and 2 pedicelled spikelets. Joints and pedicels filiform, longitudinally grooved or depressed and translucent in the centre, leaving a minute transverse truncate or very shallowly cupular scar on the peduncle after falling. Sessile spikelet dorsally compressed, callus short rounded shortly bearded. Gl. i 2-keeled, with narrow inflexed margins; ii cymbiform and more or less 3-keeled or 3-nerved, the awn of gl. iv fitting into the rounded central keel; iii hyaline, nerveless or 0; iv reduced to the acutely based awn. St. 3. Lodicules minute. Grain ellipsoid-oblong or oblong. Ped. spkt. narrower than sessile: gl. i dorsally flattened; ii usually rounded on back; iii oblong hyaline, with 3 stamens and a very narrow palea (rudimentary gl. iv ?) or palea 0.

Panicle oblong. Sess. and ped. spkts. equal. Ped. spkt. with 4 glumes	1. *parviflorum.*
Panicle pyramidal. Ped. spkt. much longer than sess., with 3 glumes	2. *assimilis.*

1. **C. parviflorum,** *Stapf.* var. villosulum. Syn. Andropogon micranthus, *Kuth.*; var. villosulus, *Hack.*

Stems polished rather stout 2–4·5 ft. high, nodes bearded, hirsute, or very hairy on the leaf-sheaths and leaves, at least the lower. Leaves 6–12″ by ·17–·25″, or up to ·4″ (in Neterhat specimens), flat, setaceously acuminate, ligule short truncate, hairs with tubercle bases. Panicle decompound effuse, red, oblong or narrowly pyramidal, 2–8″, primary branches clustered 2–4-together, unequal, 1–2·5″ long, repeatedly bifurcate or 3-furcate with capillary quite glabrous, flexuous, spreading branchlets. Spikes reduced to one sessile and 2 pedicelled spikelets with sometimes an extra 1–2 prs. of spkts. below them, joints and pedicels usually villous on one margin only. Sessile spkt. linear-oblong to ell.-oblong ·11–·15″ long. Gl. i dorsally hispid and with somewhat longer hairs on the keels, rather opaque and obscurely 2-nerved between the keels; ii sub-3-keeled, also with inflexed margins, sparsely hispidulous or puberulous; iii short, obtuse, nerveless (I cannot find it in some fls.); iv awn ·5–·7″ long. Anthers red ·08″.

Champaran, Ramnagar Hills, 2000 ft.! Ranchi and Palamau, above 2000 ft. (Neterhat, frequent)! Parasnath (Hazaribagh), elev. 2000 ft. to top, where it has been collected by *Hooker, Clarke*, etc.! Fl., Fr. Sept.–Nov. Perennial.

Ped. spkt. with pedicel about two-thirds to four-fifths as long as spkt. Spkt. as long as sessile. Gl. i 5–7-nerved, scarcely keeled, margins incurved, minutely hispidulous, acute; ii with incurved villous margins, 3–5-nerved; iii broadly

oblong with 3 stamens; iv (or palea of iii?) linear, hyaline, sometimes split and one segment ending in a filiform tip. The two ped. spkts. and their pedicels often unequal.

The fresh panicle is distinctly and rather unpleasantly scented.

2. **C. assimilis,** *comb. nov.* Syn. Andropogon assimilis, *Steud.*

A copiously branched grass with creeping rootstock, easily recognised by its hard almost woody slender polished stems, short leaves and short diffuse pyramidal panicles 2–5″ long by 2–3″ broad with capillary clustered primary branches, and spikes of only 2–3 prs. of spikelets and a terminal trio. Nodes of panicle ciliate, joints and pedicels slender, villous, ending in a minute shallow cup with transverse rim. Pedicelled spikelet much larger than the sessile.

Northern Champaran, gregarious under shade in some hill forests! Valleys in the Rajmahal Hills! Singbhum, forest valleys! Hazaribagh, especially on Parasnath! Western Bengal and Behar (without district), *Kurz*! Ranchi ghats! Valleys in the hill forests of Palamau! Fl., Fr. Oct.–Dec.

Attains 6 ft. in height in the upper hill forests, not more, often sarmentose and proliferously branched, nodes bearded. L. lower lanceolate, upper linear, 2–5″ long, setaceously acuminate, glabrous or sparsely hairy, margins scabrid. Main branches of panicle 2–4 in a cluster, flexuous. Sessile spkt. ·09″, gl. i pale, ell.-oblong, narrowly truncate, 2–4-nerved between the keels which are hispid above; ii slightly longer, lanc.-oblong with rounded keel in which the awn lies; iii half i; iv reduced to the acutely based ·4–·5″-long awn. Grain oblong ·05″. Ped. spkt. ·14–·15″ long, with pedicel about two-thirds sess. spkt.; gl. i 3–7-nerved very acute, keels sparsely hispidulous; ii back rounded, 3-nerved, mid-nerve excurrent as a minute mucro; iii broadly lanceolate nearly as long as i; anthers ·07″ long.

68. AMPHILOPHIS, *Nash.*

Perennials. Panicles with a short primary axis so that the branches or spikes are sub-digitate or elongate. Spikes often simply branched, frequently with tubercled axils; joints and pedicels many filiform, longitudinally grooved and translucent along the groove, disarticulating horizontally. Pairs of spikelets sessile and pedicelled, heterogamous and sometimes dissimilar in shape. Sessile spkt. with small shortly bearded callus dorsally compressed. Gl. i thinly chartaceous to membranous, 2-keeled, with narrow sharply inflexed margins: ii cymbiform, acutely keeled, 3-nerved; iii hyaline nerveless, palea 0 or very minute; iv reduced to the hyaline base of the slender awn, palea minute or 0; lodicules minute, glabrous. Stigmas exceeding the styles. Grain oblong obtuse. Ped. spkt. awnless, usually narrower than the sessile and male; gl. i many-nerved, iv 0 (awnless).

A. Panicle-branches mostly with axillary ciliate tubercles. Gl. i often pitted, iv the simple base of awn:—
  Panicle-branches or spikes much shorter than rhachis. Sess. spkt. ·12–·14″ . . . . . 1. *glabra.*
  Spikes more or less fascicled, longer than the rhachis. Sess. spkt. ·15–·17″ . . . . . 2. *pertusus.*
B. Panicle-branches without axillary tubercles. Gl. i not pitted:—
  Panicle-branches longer than panicle-rhachis. Sess. spkt. ·2″. Gl. iv simple base of awn . . . . . 3. *Kuntzeana.*

1. **A. glabra,** *Stapf.* Syn. Andropogon intermedius, *R. Br.*, inc. A. glaber, *Roxb.*, A. punctatus, *Roxb.*, and A. montanus, *Roxb.* ? Sudugan, *K.*; Gandha-gurana, *Beng.* (*fide Roxb.*).

A very common and variable grass flowering from 12″ high (probably in its first year and then appearing annual) to 7 ft. with many

stems from the perennial rootstock. Culms erect or decumbent at base, usually 3–6 ft., nodes with a dense ring of hairs which fall off in age, straw-coloured, simple or much branched above, up to ·2–·25″ diam. at base, polished but lower parts usually covered with numerous loose dry sub-compressed leaf-sheaths. Leaves glabrous or very hairy, nearly always with long setæ towards base, narrowly to broadly linear, middle cauline 12–15″ by ·2″ or often 20″ by ·3–·55″ with strong midrib, 3–4 or 6–7 strong nerves between the setulose margin and midrib, apex finely caudate, broadest at base; sheath somewhat compressed loose glabrous or hairy, ligule very short truncate with usually strigose erect hairs on the blade behind it, itself glabrous exc. ciliolate margin. Panicle often red, rhachis 3–7″ much longer than the spikes, more or less regularly pyramidal or oblong with alternate, opposite, or irregularly subverticillate glabrous (below the spikes) branches always with ciliate tubercles in their axils and with small glabrous cupular tips, simple (bearing a single spike) or more or less compound; internodes of panicle glabrous, lower long, gradually shorter. Spikes with joints and pedicels subequal, about half to two-thirds length of sessile spkt., compressed, bearded on both margins, with thin translucent centre between the thickened margins. Spikelets with obtuse callus with beard less than one-eighth length of spkt., narrowly elliptic-oblong or ped. spkt. convolute and linear. Sessile spkt. ·12–·14″ long, gl. i flattened 2-keeled with narrowly inflexed margins, obtuse or narrowly truncate, pitted or not, usually more or less dorsally hairy in lower half and keels hispid- or scabrid-ciliate above, 4–9-nerved between the keels; ii cymbiform polished acute, subequal, faintly 3-nerved, rarely ciliolate; iii ·09–·1″, broadly oblong or lanceolate, hyaline, obtuse, nerveless, glabrous; iv reduced to the narrow base of the ·4–·7″ long slender geniculate awn which is smooth below, scabrellous above; palea 0, lodicules minute quadrate-cuneate, anthers 3 brown ·05″, ovary minute, grain oblong ·08″ long. Pedicelled spkt. always neuter with usually only one glume, rarely 2–3, usually shorter than sessile spkt., gl. i similar with more nerves between the less marked keels, often (as in the sessile) with 1–3 median pits.

Distributed throughout the whole province and one of the commonest grasses in forest glades as well as more open tracts, also occurring under shade. Perennial. Fl., Fr. Oct.–Jan. In addition to the localities noted under the following varieties* I have also recorded the plant, without notes of variety from Champaran (common) and Gya!

I. Panicle usually thin, branches opposite each bearing only one spike or sometimes 2 (branches subverticillate in var. *lævis*). Spikelets usually purple:—

A. Gl. i appressed hairy below the middle, not pitted, keels hispid-ciliate above . . . . . *α. genuinus, Hack.*

1. Leaves and sheaths usually broad, hairy, 7-nerved each side of midrib.

One form from Singbhum has pale, not purple panicle. Singbhum, common! Palamau! Angul, *Lace*! Probably in all districts.

* These varieties are after *Hackel* and were described before I consulted *Stapf's Gramineæ* in *Fl. Trop. Africa*, where he reduces *Hackel's intermedius* to *Roxburgh's glaber*. The names (*e. g. genuinus*) in some cases become inapplicable if *Roxburgh's glaber* is the type. Var. *Haenkii* is, I think, a distinct species and easily distinguished in the field. It should be called *Amphilophis Hoenkii*.

2. L. glabrous. Gl. i sometimes dorsally villous above middle. Rhachis of panicle short.
Singbhum, *Clarke*! This comes very close to *A. Grahami*, *Haines*.

B. Gl. i thinly or not hairy below middle, 1-3-pitted in many spkts. both sessile and pedicelled . . . β. *punctatus*, *Hack*.
One form from Parasnath, *Clarke*! has pale panicles. Singbhum, common! Santal Parg., on the hills, very common! Hazaribagh, *Clarke*! Probably all districts.

C. Gl. i with back shortly uniformly hairy or hispid . γ. *hirta*, *Haines*.
Sambalpur! Stem tall ·2″ diam. much branched above. L. ·3–·4″ wide sparsely hairy towards base and strigose behind ligule. Sess. spkt. ·13″, keels scabrid, awn ·1″.

D. Gl. i glabrous, 7–9-nerved between the keels. Panicle with sub-verticillate branches . . . . . δ. *glabra*, proper?
Angul! Tufted, 4 ft. high. L. glabrous slender with 3–4 nerves each side of midrib. Spkt. ·14″ long. This might be *Roxburgh's glaber*, except that the glumes are not pitted. From *montanus* it appears to differ in the much larger spikelets. It forms a transition to the next group :—

II. Panicle dense with many sub-verticillate branches which each bear branched spikes with generally a sessile spkt. at each fork (without ped. companion).* Gl. i usually medianally depressed and somewhat hairy below. Panicle not purple . . . . . ε. *Hoenkii*, *Hack*. (including *A. fasciewlaris*, *Stapf*).†

A. Leaves glabrous or ciliate below.
Ranchi, common! L. usually narrow and only 3-nerved each side, panicle 7–8″. Manbhum, *Camp.*! Panicle 8″. Rajmahal Hills, *Kurz*! L. 5-nerved each side. Orissa, *Walsh*! Stout below, panicle 7″, keels of gl. i scabrid only.
Form with nearly or quite glabrous gl. i occurs in Monghyr, *Mokim*! and Gya, *Mokim*! Sarguja, *Clarke*! Parasnath (called *fasciewlaris* at Kew).

B. L. hairy (but less so than in most *genuinus* and *punctatus*). Gya, *Mokim*! Parasnath, *Prain*!

2. **A. pertusa,** *comb. nov.* Syn. Andropogon pertusus, *Willd.*

A creeping, ascending or erect grass, slender or with culms ·12″ diam. up to 1–3 ft. high, nodes more or less bearded. Spikes 1–1·7″ long digitately fascicled or one or more somewhat distant from the others and racemose, but rhachis of raceme always much shorter than the spike. Joints and pedicels slender subequal, translucent in centre, about half to four-fifths spkt., villous on both margins. Sessile spkt. ·15–·17″ long (·2″, *J.D.H.*), gl. i narrowly elliptic-oblong narrowly truncate or minutely 2-cuspidate from the strong hispid produced keels, back flat with a dorsal pit above the middle and a tuft of villi usually below or glabrous, 5–7-nerved between the keels. Callus obtuse with unequal hairs about one-fourth spkt.

Monghyr, *Mokim*! Gya, *Mokim*! Santal Parg., *Nusker*! Behar, *J.D.H.*! Ranchi, *Clarke*, etc.! Singbhum! Manbhum, a common grass, *Camp.*, etc.! Orissa, Puri, and again without district, *Walsh*! Fl., Fr. Oct.–Dec.

* This and similar cases show that the pedicel is morphologically a branch of nearly equal value to the rhachis.

† *Amphilophis fasciewlaris*, *Stapf*, is not *Andropogon fasciewlaris*, *Roxb.* See remarks under *Sorghum fasciewlaris*. This group might be called *Amphilophis Hoenkii*.

L. 2–12″ long (*F.B.I.*, not over 6″ in our specimens), ·1–·17″ broad with long hairs near the base and often shortly hairy on one or both surfaces, scaberulous after fall of the hairs. Sheaths usually scaberulous. Ligule short, membranous, truncate. Spikes usually 3-9. Sessile spkt. gl. ii cymbiform acute or acuminate, keeled and with marginal nerve and sometimes 1–2 faint ones between keel and each margin, slightly longer than i; iii narrow lanceolate hyaline about four-fifths i; iv the slightly dilated base of the ·5–·75″-long capillary awn. Ped. spkt. equals the sessile. gl. i keels sometimes minutely produced, 11-nerved (7-13-, *F.B.I.*), glabrous, pitted or not, keels ciliolate; ii flat dorsally, 3–5-nerved, obtuse; iii broadly oblong (linear-oblong, *F.B.I.*) glabrous.

The following form or varieties occur:—

α, **genuinus,** *Hackel.* Gl. i thin, not shining, villous below the middle, spikes 3-9. Singbhum and Manbhum (*see above*).

The others have very shining gl. i often glabrous, and glabrous leaf-sheaths, but it is not apparent under which of *Hackel's* varieties they come unless **insculptus** with gl. i sometimes 2-pitted and the keels of gl. i longer ciliate which they sometimes are. Var. *genuinus* has sometimes shining glumes.

3. **A. Kuntzeana,** *comb. nov.* Syn. Andropogon Kuntzeanus, *Hack.*

Stout, about 4 ft. high with culms ·25″ diam. at base, nodes mostly densely villous. Leaves and sheaths glabrous, blade up to 2 ft. by ·3″ or upper appressed hairy within above the short hard truncate ligule, blade narrow up to 2 ft. by ·3″ tapering from base to tip, with 5–7 strong nerves between margin and midrib, margins setulose. Panicles 3″ with the rhachis much shorter than the alternate, rarely also opposite, simple peduncled spikes which lack the axillary ciliate tubercles of *pertusa* and *glabra*. Spikelets purple, callus obtuse bearded. Sessile spkt. ·2″: gl. i thinly hairy on lower half dorsally, narrowly elliptic-oblong, obtuse, keels hispidulous above; ii cymbiform, very acute, ·18″ long, 3-nerved; iii hyaline, ·14″, broadly oblong, obtuse; iv linear 1-nerved forming the base of the short nearly straight awn which is only ·25″ long. Palea ciliate one-third gl. iii. Ovary small with 2 long styles and plumose stigmas. Ped. spkt. ·18″, gl. i like that of sess. spkt. but 9–11-nerved between the keels and often punctate above the middle; ii oblong obtuse with rounded back, hyaline with 5 green nerves, subequal; iii ell.-oblong hyaline ciliate obtuse ·15″ with 2 lodicules and 3 stamens, palea minute ciliate, anthers linear, yellow, ·09″ long.

Chiefly on rocks in streams, Sant. Parg.! Towards top of Parasnath, *J.D.H.* Fl. Dec.

The Santal Parganah's plant is much stouter than any specimens at Kew and is the one more especially described.

69. VETIVERIA, *Thouars.*

Coarse perennial nearly glabrous grasses with stout rhizomes, and culms more or less compressed below. Lower leaf-sheaths much compressed, flabellate-imbricate, leaves firm, conduplicate in bud, flattening out upwards, gradually passing into the sheath. Spikelets 2-nate, sessile and pedicelled, subsimilar, differing in sex, on the articulate fragile rhachis of peduncled 3–many-noded racemes which are in many-rayed whorls round the rhachis of nearly simple elongate panicles, racemes rarely compound hispidulous or glabrous except for the frequently shortly bearded calli. Joints and pedicels slender, slightly thickened upwards. Sessile spkts. slightly laterally compressed, awned or not; glumes 4, i more or less coriaceous with broad

rounded back and sub-inflexed margins: ii cymbiform keeled upwards, with broad hyaline ciliate margins sometimes aristulate: iii hyaline empty 2-nerved: iv hyaline minutely 2-toothed, muticous mucronulate or awned from the sinus, palea minute, nerveless; lodicules glabrous. Stamens 3. Grain oblong, top slightly oblique. Pedicelled spkt. dorsally compressed, glumes thinner than in the sessile, usually awnless, male.

1. **V. zizanioides,** *Stapf.* Syn. Phalaris zizanoides, *L.*; Andropogon squarrosus, *Hack.*; Andropogon muricatus, *Retz.*; Khatra, *Th.*; Sirom, *K., S.*; Kas-kas, *H.*; Bena, *Or.*; Kus-kus, *Eng.*

A stout tufted often gregarious rigid grass. Leaves closely distichously imbricate at base, suberect, conduplicate below and often hairy (always ?, they are usually described as glabrous) within, glabrous upwards, 1–2 ft. long on the stem (radical much longer), rarely over ·3″ wide, margins distantly setulose-scabrid, larger nerves about 6–8 each side of depressed (above) midrib, ligules a mere rim. Panicle 6–12″ oblong or pyramidal. Spikelets muricate and muriculate, linear to linear-lanceolate, sessile ·13–·17″, pedicelled shorter.

Open damp or almost swampy ground, often gregarious. Champaran! Purneah, very common! Santal Parg.! Monghyr, *Mokim*! Chota Nagpur, all districts on low ground, not common on the plateau, sometimes found in forest glades! Puri, *Walsh*! Angul! Sambalpur! No doubt therefore in all districts. Fl., Fr. Aug.–Jan. Perennial.

Lower panicle branches (with the raceme) up to 4″ long, erecto-patent or suberect. Raceme with flexuous rhachis. Joints as long as or usually much longer than the sessile spkts., tips truncate or slightly oblique, minutely or scarcely ciliolate. Callus unequally shortly bearded on one side.

The dried roots are well known, being the material of which kus-kus tatties are made and yield a delightful fragrance when wetted. The fresh root is only slightly odorous.

70. SORGHUM, *Pers.*

Annual or perennial, often robust grasses. Leaf-blades usually flat and large, convolute in bud. Panicles erect or nodding with scattered, fascicled or verticillate branches, often large (in cultivated forms frequently very dense). Spikelets 2-nate, those in each pair differing in form and sex, one sessile, the other pedicelled or reduced to its pedicel, on the articulate fragile or (in cultivated forms) tough rhachis of panicled few- (sometimes only 1-, rarely up to 6–8-) jointed spikes. Glumes 4; i and ii equal coriaceous, rarely permanently chartaceous, muticous, i with a broad flattened or convex back with the margins narrowly inflexed near the tips and elsewhere involute; ii cymbiform with narrow hyaline usually upwards ciliate margins: iii empty hyaline ciliate: iv oblong to ovate 1–3-nerved, 2-lobed or -dentate with an awn or mucro from the sinus, lobes sometimes adnate to the awn. Palea hyaline, often minute or 0. Lod. glabrous or ciliate. St. 3. Styles terminal or subterminal. Grain (in the wild species) mostly obovoid, dorsally compressed. Ped. spkts. if present much narrower than the sessile, male or neuter, sometimes reduced to 1 or 2 glumes, permanently herbaceous; iii and iv if present 1–2-nerved hyaline ciliate awnless.

I. Cultivated. Annual. Panicle usually dense. Rhachis of spikes tenacious . . . . . 2. *vulgare*.
II. Wild species. Perennial. Panicle usually lax. Rhachis of spikes fragile :—
A. Spikes 3–4-noded. Spkts. green or red . . . . . 1. *halapense*.
B. Spikes 2-8-noded :—
Spkts. black, callus hairs deep brown . . . . 3. *nitidum*.
Spkts. white, callus hairs white . . . . . 4. *fascicularis*.

1. **S. halapense,** *Pers.* Syn. Andropogon halapensis, *Brot.*

A stout grass with a long creeping stoloniferous rootstock, which has appressed hairy sheaths at its nodes. Culms 2–3 ft. high only or attaining 8 ft. and ·25″ diam. sometimes decumbent at the base with numerous adventitious roots, nodes finely silky-pubescent. Leaves broadly linear setaceously acuminate, rarely 1″ wide (in our area), somewhat tapering to the broad rounded sub-amplexicaul base, junction of sheath and blade often pubescent or villous externally and densely silky or villous inside above the ligule, otherwise glabrous, margins setulose broad, about 6–8-nerved between margin and midrib, sheaths rather loose glabrous except at the nodes, ligule ·08″ erose strigosely hairy behind. Panicle 5–10″ long with sub-erect or diffuse branches which are angled and often scabrellous on one of the angles upwards, 1–3-nate, distant, villous at their axils with alternate branches and spikes in their upper half or more. Spikes sometimes branched with a branch taking the place of the pedicelled spkt., 3–4-noded, joints longer than the pedicels, compressed, margined, villous ending in a minute cup, easily disarticulate and the ripe sessile spikelet falling (as in most *Andropogoneæ*) with the joint of the rhachis and the pedicelled spikelet. Sess. spkt. elliptic or narrowly elliptic, acute, ·18–·22″ long, callus hairs short spreading. Gl. i dorsally flattened, silkily villous or centre glabrescent, keels pectinately hispid in upper third, about 11-nerved altogether or 7-nerved between the keels, margins incurved or inflexed.

Along rivers and streams, where it is sometimes gregarious. Singbhum! Monghyr, *Mokim*! Perennial. Fl. Oct.–Dec.

Sessile spkts. gl. ii narrower than i, very convex or keeled upwards, very acute or almost cuspidate, 7-nerved, sparsely silky on back, keel scabrid; iii little shorter than i and ii, broadly lanceolate, hyaline, margins inflexed from the 2 marginal nerves which are ciliate; iv about three-fourths i, either broadly oblong obtuse without an awn (the most of the spkts.) or awned from near the base and 2-fid, always very ciliate or sub-fimbriate, awn when present ·4–·5″. Lodicules fleshy compressed quadrate crescentic at top with a few cilia on each horn. Anthers ·1″. Grain obovoid fuscous, ·07″. Ped. spkt. linear ·16″ (Monghyr) to lanceolate ·24″ (Singbhum), pale green to red; gl. i narrow-lanceolate 7-nerved, dorsally depressed between the prominent hispid keels and margins inflexed, subcuspidate, 7-nerved; ii cymbiform-lanceolate sharply acuminate, 5-nerved, midrib scabrellous, inflexed margins silky; iii about three-fourths i, glabrous 2-keeled and with incurved margins (Singbhum) sparsely ciliate (Monghyr); iv (0 in Monghyr specimen) two-thirds iii with base embracing the red lodicules.

Hooker states of this grass that "it is no doubt the wild form of *Andropogon Sorghum*" (*Sorghum vulgare*). It is a good fodder and the grain is eaten.

2. **S. vulgare,** *Pers.* Syn. Andropogon Sorghum, *Brot.*; Gangai, *K.*; Juar, *H.*, *S.*; Sissua, *Mal Pah.*

A stout usually tall annual with broadly linear leaves with a prominent white midrib and a usually thyrsiform decompound panicle with crowded whorls of erect branches and branchlets, rarely subeffuse.

Rhachis of spike tenacious, joints leaving a ragged scar at the tip when forcibly separated. Pedicelled spkts. usually neuter, pedicels short.

Frequently cultivated in the Northern area, sparingly on the Chota Nagpur plateau or in the Southern area! Usually reaped Nov.–Dec.

Hackel makes 37 varieties of this plant. *Stapf* has made several species of it. The material at my disposal is altogether inadequate to assign most of the B. & O. crops to one or the other. The following forms only have been noted:—

Var. **Roxburghii** (*F.B.I.* vii, p. 184). Syn. *S. Roxburghii*, *Stapf*. Panicle oblong dense. Sess. spkt. ·2″, ovate acuminate awnless. Gl. i of sess. spkt. not depressed below the tip, very villous, tip hyaline, nerves obscure. Monghyr, *Mokim*!

Var. **vulgaris** (*loc. cit.*). Panicle erect contracted or sub-effuse. Spikes several on the flexuous branches, axils villous. Gl. i of sess. spkt. distinctly 10-nerved below tip, ·2″, tip ¿acute depressed and triangular above, villous, apiculate; ii 7-nerved; iii while silky; iv 2-fid with awn ·25″. Chota Nagpur!

Var. **cernuus** (*loc. cit.*). Syn. *S. cernuum*, *Host*. Very robust with a thick dense ovoid cernuous head. Frequent!

3. **S. nitidum,** *Pers.* Syn. Andropogon nitidus, *Kunth.*; Sorghum serratum, *Haines* (C.P. List); Andropogon serratus, *Thunb.*; Sorghum fulvum, *Beauv.*

A tall tufted grass 3–8 ft. high, densely villous at the nodes and with leaf-sheaths villously hairy on one side. Leaves on stem 9″–2·5 ft. by ·3–·8″ with narrow long-hairy base. Readily recognised by the brown or black shining and brown-hairy spikelets in 2–8- (usually 2–4-) nodal spikes solitary at the ends of the filiform sub-verticillate branches of a subsimple lax oblong panicle 5–12″ long.

Rocky shady hill forests. Santal Parg.! Singbhum, frequent! Manbhum, *Campbell*! Hazaribagh, on Parasnath, *Clarke*, etc.! Palamau, frequent! Fl., Fr. Sept.–Dec. Perennial.

L. setaceously acuminate, with prominent white midrib, often sparsely hairy on both surfaces, hairs often tubercle-based, margins scabrid, cutting, mouth of sheath silkily villous; ligule very short truncate. Rhachis and branches of panicle often flexuous, ·75–2·5″ long. Joints and pedicels equal, bearded, one-half to two-thirds sess. spkt. Sess. spkt. broadly ellipsoid ·15″ long, callus rounded (acute, *F.B.I.*); gl. i broadly oblong or elliptic acute or obtuse, dorsally flattened with incurved margins, brown-hairy and keels hispid, 7-nerved, or about 3-nerved between keels, sometimes nearly black, polished; ii broadly cymbiform with rounded back, truncately acuminate, margins hyaline ciliate; iii as long, hyaline, margins inrolled, 2-keeled, ciliate; iv linear-oblong ·08″ long, 2-lobed and with an awn ·5″ long from about midway, or the awn of lower spkts. 0 (according to *Hackel Andropogon serratus* var. *genuinus* has gl. iv 2-lobed and awned and var. *nitidus* has gl. iv entire awnless! All our specimens have some of the spkts. with awns). Ped. spkt. linear-oblong. ·12″, pale or greenish with brown hairs; gl. i oblong rounded or sub-truncate, dorsally depressed and 2-nerved between the keels; ii equal, rather narrower obtuse, margins much inflexed, 3-nerved between keels; iii linear hyaline, male.

4. **S. fascicularis,** *Haines.* Syn. Andropogon fascicularis, *Roxb.*; Sorghum gangeticum, *Stapf.**

Erect slender simple or branched 2–3 ft. high (3–5 ft. *Roxb.*), culms with glabrous or slightly villous nodes. Leaves very slender, sometimes only 1–2″ long and ·06″ wide, but in other cases attaining 16″ by ·4″, finely acuminate with sparse tubercle-based hairs near the base

* *Stapf* considered the *Andropogon fascicularis* of *Roxburgh* to be an *Amphilophis* and has named an *Amphilophis* accordingly. But neither *Roxburgh's* description nor his detailed drawing are consistent with an *Amphilophis*, and although the general (habit) figure is somewhat more like an *Amphilophis* it also very well agrees with some specimens of this *Sorghum*.

and on the margins of the sheaths, about 4-nerved each side of midrib. Panicle pale, from nearly simple to compound, branches fascicled never as long as main rhachis, nodes sometimes slightly villous, joints and pedicels equal compressed more or less translucent channelled (subterete, not or obscurely channelled with no translucent centre. *F.B.I.*), densely villous on margins, the villi usually covering the face of gl. ii. Sessile spkt. ·16–·18″ long, very shining glabrous dorsally. Gl. iv ·08″ deeply 2-fid the segments appearing as wings to the ·5–·6″ long awn. Pedicelled spkt. with 3–4 glumes and male, base obtuse.

Santal Parg. (Rajmahal Hills), *Kurz*! Singbhum, *Clarke*! Manbhum, *Clarke*! Palamau (Betlah and Kechki forests)! Fl., Fr. Oct.–Nov.

Sessile spkt. with rounded slightly bearded callus. Gl. i ell.-oblong, hispid on the keels above, 6–8-nerved between the keels, truncate; ii equal or slightly longer, cymbiform or with rounded back, delicately 5–9-nerved; iii lanceolate hyaline, a little shorter, obtusely acuminate, ciliate; iv 2-fid to below the middle, ciliolate with very delicate palea. Grain oblong fusiform, dark brown, ·08″ long. Ped. spkt. ·15–·19″ long; gl. i 9-11-nerved; ii cymbiform with keel ciliolate; iii four-fifths i, lanceolate ciliolate; iv, if present, over half i, narrowly oblong entire ciliolate (perhaps the palea of iii).

71. CHRYSOPOGON, *Trin.*

Perennials with narrow leaves, ligule of minute hairs, and mostly lax panicles with whorls of simple or basally divided filiform branches, rarely the branches only 1–2-nate. Spikes of 3 spikelets (one sessile and 2 pedicelled) at the ends of the branches, the triplets falling together from the thickened obconic obliquely truncate tips which are crowned with a ring or beard of stiff hairs. Sessile spikelets narrow, laterally compressed; gl. i linear or narrow, rigid, usually 4-nerved and laterally compressed; ii broader, more or less cymbiform, 3-nerved, tip 2-lobed, awned or not; iii hyaline 2-nerved; iv the narrow hyaline 1–3-nerved base of a long awn; palea 0 or small. Lodicules glabrous. Grain linear, laterally compressed. Pedicelled spkt. dorsally compressed; gls. i and ii awned or not.

I. Small, 1–2 ft. Callus of sessile spkt. very long (as long as spkt.) acicular. Spkts. ·15″ . . . . . 1. *aciculatus.*
II. Stout or slender, mostly over 3 ft. Callus shortly adnate, not nearly as long as spkt. Spkts. over ·15″:—
  A. Pedicels half as long as sessile spkt. or longer. Ped. spkt. over ·3″. Panicle 6–12″:—
    Panicle oblong, lower branches mostly less than twice the internode. Spkt. hispid on nerves. Ped. spkt. under ·4″ 2. *lancearius.*
    Panicle ovoid or lanceolate, very dense, more than twice length of internode. Spkts. glabrous. Ped. spkt. over ·4″ long . . . . . 3. *Hamiltonii.*
  B. Pedicels less than half as long as sessile spkt. Panicles 3–6″ . . . . . 4. *montanus.*

1. C. aciculatus, *Trin.* Syn. Andropogon aciculatus, *Retz.*; Chorakanta, chui-kanta, *Vern.*

A small grass 12–18″ high with creeping stem and short densely tufted leaves 1–5″ by ·12–·2″. Panicle very narrow 1–4″ long, usually turning red or purple, with capillary branches solitary and subverticillate apparently scaberulous or villous below the spikelets from the villous callus being produced downwards and adnate on one side in a long needle-like appendage ·15–·17″ long separating when the spikelets

are ripe. Sess. spkt. ·14″ long; gl. i linear acuminate or minutely 2-cuspidate, convex with inflexed margins, keels hispid above; ii cymbiform aristulate ·18″ long with the awnlet, keel hispid above; iii ·1″ hyaline lanceolate ciliate with inflexed margins, 2-nerved; iv with its scabrid awn ·2–·3″, palea oblong hyaline obtuse glabrous about half iii. Pedicels about ·1″, often unequal. Ped. spkt. ·16–·2″ including the cuspidate scabrid cusp of gl. i; ii rather shorter aristulate; iii and iv hyaline shorter softly villous, male.

A weed of damp and heavily grazed lands, and a pest from the sharp callus and small awns sticking to the clothes. The leaves which lie close to the ground escape to a large extent the lips of cattle. Most frequent in the Northern districts esp. Purneah and Santal Parg.! but occurring in all. Fl., Fr. Aug.–Nov.

2. **C. lancearius,** *comb. nov.* Syn. Andropogon lancearius, *Hook, f.*; Korpo dumbu, *K.*

A large coarse grass 4–6 ft. or more high and culms ·2–·25″ diam. at base, compressed, with dry leaf-sheaths below, very leafy above; minutely downy below the panicle. Leaves 18″–2 ft. by ·3–1·5″ broad with spinulose-serrulate cutting edges. Panicles oblong 6–12″ long very many-rayed, with irregularly verticillate capillary suberect branches 2–4″ long which exhibit the characteristic clavate oblique brown-bearded tips (seen best after fall of spkt.). Sessile spkt. ·25″ long, callus elongate ·05″ long and pedicels at base adnate to it, pungent and with a barb of brown hairs, shortly adnate to the oblique brown-bearded tip of peduncle. Gl. i conduplicate, tip oblique, 2-nerved each side, slightly scabrous on nerves; ii as long but much broader, conduplicate and each side ·04″ broad, keel rounded, 3-nerved hispid, and broad membranous margins pilose, awn ·3–·4″ long slender; iii hyaline, ·16″ (reaching the tips of the anthers), ciliate; iv membranous linear, not 2-fid but the sides meeting in front of the 1·5–1·75″ long awn which is stout and hairy up to the knee, then slender and scabrid. Pedicels compressed somewhat translucent, bearded on each margin with long brown hairs, about ·2″ long or slightly exceeding half the sessile spkt.

Usually in shaded positions on rocky hill sides. On grassy spurs, North Champaran! Monghyr Hills, *Kurz*! Gaya ghats, common! Singbhum, frequent! Palamau! Hazaribagh (in Koderma forest)! Ranchi, *Clarke*, *Prain*! Sambalpur! Fl., Fr. Sept.–Nov.

After the fall of the spikelets it may be recognised among its congeners (exc. *Hamiltonii*) by the robust habit and the culms minutely pubescent below the large panicle. L. only slightly narrowed towards the rather broad base, sheaths very smooth, ligule a rim with a close band of short silky hairs. Ped. spkt. ·28–·4″ long, subterete, the two of each pair not always quite alike, more especially in regard to the existence or length of the awns. Callus with linear-oblong oblique scar. Gl. i finely acuminate and awned, 7-nerved, awn usually about ·25″; ii acuminate long-ciliate subaristulate or (in a Gaya specimen collected by *Mokim*) with an awn ·1–·12″ long; iii ·22–·27″ hyaline ciliate or villous, linear-oblong; iv similar or (in the Gaya specimen) with an awn 1″ long in some spkts. only.

The grass is a good fodder.

3. **C. Hamiltonii,** *comb. nov.* Syn. Andropogon Hamiltonii, *Hook. f.*

A tall stout leafy grass, glabrous except beneath the panicle where the culm is minutely closely pubescent. Leaves 1·5″ ft. or more by ·25–·5″ finely acuminate, smooth or minutely scaberulous above, margins scabrid. Panicle 6–10″ long by 2·5–3″ broad lanceolar dense

of many long smooth suberect branches in many closely approximate whorls each bearing 1–3 spikes. Sessile spikelet ·25–·28″ long, callus long brown-villous all round ·05″ long; gl. i polished linear-oblong, 2-nerved on each margin, the stronger (keels) slightly excurrent and scabrid at the tips; ii with brown very coriaceous 3-nerved back and membranous sides, awn ·5″ long, margins finely ciliate; iv with awn 1·8–2·5″ long. Pedicelled spkt. ·4–·5″ long; i with awn ·4–·5″ long, scabrid at the acuminate tip only. Pedicel brown-villous.

Monghyr (*Wall.* No. 8792 *a*), *Ham.*! Fl. Aug.

Hamilton's is the only collection, and I am inclined to think that this is but a form of *C. lancearius* and perhaps diseased; the only spike I have been able to dissect had certainly a diseased ovary ·2″ long. It is chiefly distinguishable by the very dense panicle and more glabrous spikelets. *Hooker* gives also the following distinctions: "L. very long linear (he calls those of *lancearius* narrowly lanceolate) scaberulous beneath (I find them no more so than in *lancearius*). Callus villous all round (whereas he describes the callus of *lancearius* as glabrous in front. This I do not understand as both have the usual oblique glabrous scar in front, that of *lancearius* being perhaps a little more pronounced). Ped. spkt. ·5″ long (but some are only ·44″ long and I have found *lancearius* with the ped. spkts. up to ·4″ long)."

4. **C. montanus,** *Trin.* (1821). Syn. A. monticola, *Schult.* (1824).*

A variable grass with usually slender erect or ascending glabrous stems, robust in some forms. Leaves very narrow glabrous, rarely pubescent or ciliate, lower sheaths compressed. Panicles rarely 6″ long, of several whorls of few or many capillary flexuous very unequal branches bearing solitary spikes, rhachis of panicle often puberulous or pubescent but culm below it glabrous. Sessile spikelets pale, ·16–·2″ long, rarely ·3″, tip of peduncle brown-bearded clavate, callus short usually ·03″ or less with oval scar and dense beard. Gl. i laterally compressed usually scabrid or ciliate above the middle, sometimes glabrous; ii dorsally more or less ciliate with short or long rigid bristles, rarely glabrous (in var. *Trinii*, *Hack.*); back rounded, sides membranous embracing the inner glumes, often exceeding i and with a short slender awn; iii shorter hyaline conduplicate ciliate; iv with a slender awn from about the middle ·5–1·5″ long. Pedicelled spkts. ·15–·2″ long; gl. i 7-nerved usually scabrous or hairy, awned or not, pedicels compressed, shortly adnate to callus, ·04–·07″ long, bearded on the edges with the hairs longest upwards.

In the hills, but not nearly so common as in the Central Provinces.

Ramnagar Hills, common! Santal Parg., *Kurz*! Gya, *Mokim*! Palamau, frequent! Ranchi, at Neterhat! Hazaribagh, on Parasnath, *Clarke*! Angul (common in Durgapur range)! Sambalpur, very common! Fl., Fr. Sept.–Dec.

Stems sometimes fastigiately branched above. Leaves with scaberulous margins, lower sheaths usually compressed, ligule a belt of short hairs. Panicle branches in whorls of 3–12, smooth or scaberulous. Spikelets variously coloured pale to purple. Sess. spkt. gl. i with rounded tip; ii conduplicate with rounded back and membranous broad sides ·03–·05″ wide, tip ending in two short rounded lobes, awn sometimes recurved; iii hyaline, about ·18″; iv 1–3-nerved, the midrib gradually passing into the awn from the middle. Ped. spkt. gl. ii 3-nerved with incurved villous margins which close over the inner; iv about two-thirds i, linear, sparsely ciliate. Stamens usually 3.

The following forms occur in our area which are difficult to arrange under *Hackel's* varieties. Specimens from Angul and Sambalpur

* I quoted this as 1817 in *C.P. List*, the date at commencement of volume, but the "additamenta" in which the name *monticola* occurs is 1824.

were not kept. They ranged themselves under the two forms described on p. 259 of my C.P. List, which are apparently *montanus, Trin.* (described below) or *monticola* proper of the *F.B.I.*, and *robustus* (see below) :

I. Sessile spkts. ·16–·2″ long :—
  A. Leaves ·1–·2″ wide only :—
    1. Leaves glabrous on the surfaces :—
      Slender 2–3 ft. L. eciliate. Panicle 2–3″. Gl. i and ii of sess. spkt. scabrid or ii with few bristles. Ped. spkt. hispid all over ·15″ long, both awned . . . . . *α. scabrida.*
      Gya, Rajmahal Hills. *(C. serrulatus, Trin.?)*
      Slender 3–4 ft. L. with long tubercle-based cilia towards the base. Panicles 3–4″. Gl. i with few short hairs at tip ; ii with a ridge of bristles in the central three-fourths of back. Ped. spkt. ·2″ nearly glabrous, not awned . *β. montanus, Trin.*
      Saidope Forest, Palamau.
    2. Leaves pubescent on the surfaces :—
      Panicle 4″, rhachis pubescent. Gl. i scabrid-ciliate on nerves ; ii bristly along back and the bristles extending on to the awn . . *γ. pubescens.*
      Parasnath.
  B. Leaves ·3–·4″ wide, somewhat glaucous beneath :—
    Panicle 5–6″. Gl. i hispid at tip, much shorter than ii ; ii with red bristles on the back. Ped. spkt. awned or not. This is perhaps *robustus* of *F.B.I.*, but the leaves are much broader . *δ. robustus, J.D.H.?*
    Palamau.
II. Sessile spkt. ·25–·3″ long :—
  Tall, up to 6·5 ft. and ·25″ diam. at base, lower leaves 20″ by ·6″ with spinulose hispid margins and sometimes ciliate, young glaucous beneath, upper surface puberulous or hispidulous. Panicle (spkts.) pink lanceolate 5–6″. Sess. spkt. gl. i 2-dentate or minutely 2-cuspidate, hard ; ii ·05″ broad at sides, bristly above base, awn ·25–·3″ long ; iii ·22″ with villous margins ; iv ·2″ awn ·8″ long puberulous below. Ped. spkt. ·28–·3″ long, pedicels ·1″ ; i hispid or scabrid ; ii 3-nerved with villous margins ; iii 2-nerved ; iv about three-fourths iii, 1-nerved, anthers yellow ·15″ long. Hairs on callus and pedicels yellow . . . . . *ε. palamaunsis.*
  Hills of Palamau, 3000 ft.

This last is possibly a distinct species. *Hole* states that all the forms he has seen apparently pass into one another.

The grass is a valuable fodder.

72. DICHANTHIUM, *Willem.*

Perennial or annual usually slender cæspitose grasses with narrow leaves and short ligules, or ligule of hairs. Spikes solitary or in subdigitate panicles with a short primary axis, rarely spikes 2–3 on the short branches of panicle, branches or spikes shortly peduncled. Spikelets often subimbricate, 2-nate, sessile and pedicelled similar in shape or nearly so, lowest one or two pairs also homogamous, male or neuter, others differing in sex. Joints and pedicels filiform, without thin translucent centre, articulations more or less transverse. Sessile spkts. dorsally compressed, callus short rounded shortly bearded or glabrous. Glumes 4, i usually oblong obtuse 2-keeled with margins narrowly inflexed ; ii much narrower cymbiform 3-nerved, 1- or 3-

keeled, centre keel very pronounced; iii hyaline; iv reduced to the hyaline base of a slender awn, palea minute or 0; lodicules minute glabrous; grain oblong, obtuse, dorsally compressed. Pedicelled spkt. i oblong many-nerved; ii flat with sharply inflexed margins closing over the hyaline iii if present and the 3 stamens; iv usually 0, never awned.

I. Perennial. Sessile and pedicelled spkts. concolorous:—
Nodes rarely villous. Spikes 1-few. Gl. i (sess. spkt.) elliptic-oblong often winged above or denticulate. Callus glabrous. Joints and pedicels ·04–·05″ only . . . . . 1. *caricosum*.
Nodes mostly villous. Spikes 3–20. Gl. i oblong, never winged nor denticulate, with few or many long hairs. Callus shortly bearded. Joints and pedicels over ·05″ . . . . . 2. *annulatum*.
II. Annual. Sessile spkt. white villous, ped. spkt. brown glabrous 3. *Clarkei*.

1. **D. caricosum,** *comb. nov.* Syn. Andropogon caricosus, *L.*

Stem 1–2 ft. erect or ascending from a creeping base or almost entirely decumbent, slender (in our area) with narrowly linear leaves 2–5″ by ·1–·15″ (sometimes larger outside our area and see variety), finely acuminate, glabrous or sparsely hairy, ligule very short membranous truncate ciliolate. Spikes 1–4 subdigitate (shortly spicate) on the peduncle. 1–4″ long with the spikelets closely subdistichously imbricate. Sessile spkt. with callus rounded and glabrous, gl. i ·14–·15″ broadly elliptic-oblong or somewhat obovoid, rounded truncate or denticulate at the tip, often winged on the shoulders and shoulders hispid, tip often 2-toothed, back sparsely shortly hairy, 5–7-nerved between the keels, keel-nerves the only ones reaching the tip; ii oblong-lanceolate, 3-keeled, obtuse or, when opened out, narrowly truncate, glabrous. Joints and pedicels ·04–·05″ only, villous on one side and with few hairs at base and tip. Ped. spkt. ·15″ obovoid-oblong, gl. i 11-nerved, laxly hairy, shoulders scabrid. ii margins broadly inflexed closing over iii and the 3 stamens.

Ranchi, *Wood*! Manbhum, *Campbell*! Orissa, *Walsh*!

I believe there is no single character by which *caricosum* can be distinguished from *annulatum*. I have successively tested all those given in the *F.B.I.* and found them fail on specimens named by *Sir J. D. Hooker* himself; the key characters in *Bengal Plants* are also unworkable as applied to the same specimens, many of which have bearded nodes, and the character of spiral or subdistichous spikelets is difficult to apply. *Linnæus* described *Andropogon caricosus* as with solitary spikes, and *Willdenough* adds "leaves with sparse hairs and sheaths hirsute at the base" (probably he refers to the nodes).

Var. **mollicomus,** *Hack.*

This appears to be more distinct. A specimen collected by me from Bilaspur not far from our area is a very robust plant with 2-4 broad spikes up to 3″ long and ·15″ wide with very hairy peduncles and toothed bidentate winged broad glume i. The nodes are pubescent.

2. **D. annulatum,** *Stapf.* Syn. Andropogon annulatus, *Forsk.*

Cæspitose, erect or ascending from a geniculate base, 1–3 ft. high, nodes mostly bearded. Leaves linear, finely caudate, 3–6″ long ·1–·2″ broad, glabrous or slightly hairy and often with long cilia near the base, hairs often leaving small tubercle-bases. Ligule scarious short or oblong, obtuse. Spikes subdigitate (spicate on a short rhachis) 1–2″ long, 4–20 rarely fewer on a rhachis ·25–·7″ long. Joints

and pedicels ·05–·08″ long, villous one or both sides and callus scantily bearded. Sessile spikelets subimbricate, gl. i oblong, rarely elliptic-oblong, obtuse, 5-nerved between keels, tip neither winged not denticulate, shoulders hispid and with long cilia and back more or less hairy, rarely glabrous; ii with ciliolate margins; iii glabrous or ciliolate; iv awn ·3–·8″ long. Ped. spkt. about as long as sessile rather narrower, gl. i 7–8- rarely 11-nerved between the keels.

Monghyr, *Mokim*! Santal Parg., frequent, *Kurz, Gamble*, etc.! Singbhum! Manbhum, *Camp.*! Fl. Aug.–Nov.

The spikes are sometimes compound and the branches have ciliate tubercles in their axils otherwise their peduncles are glabrous.

3. **D. Clarkei,** *comb. nov.* Syn. Andropogon Clarkei, *Hack.*

A very distinct and pretty species, very slender and much branched, 12–18″ high; nodes mostly pubescent. Leaves 2–4″ linear to almost linear-lanceolate, up to ·15–·2″ broad in the middle, cuspidately acuminate, ligule of hairs. Spikes solitary ·7–1″ long, on capillary peduncles scarcely exserted from the spathiform leaf-sheaths or leaves (the bases of which embrace them). Easily recognised from the contrast of the very white villous joints and pedicels, white-tomentose gl. i of the sessile spikelets, and dark brown glabrous pedicelled spikelets. Sessile spkts. distichously secund, pedicelled distichous.

Parasnath, at the top, *Clarke*! Fl. Sept.–Oct. Annual.

Joints and pedicels sulcate, two lowest pairs of spikelets neuter. Other sess. spkts. ·12″ long, gl. i elliptic-oblong truncate 2 toothed, keels scaberulous, callus very short; ii white, narrowly cymbiform, margins ciliate; iii oblong hyaline ciliate; iv, awn ·5–1″ long.

73. HETEROPOGON, *Pers.*

Short or usually tall grasses with linear or sub-ensiform leaves and solitary terminal many-jointed spikes. Spikelets 2-nate, sessile and pedicelled, lowest 2–8 prs. closely imbricate subsimilar in shape and colour and alike in sex, male or neuter, awnless, their joints firmly cohering, the sessile and pedicelled spkts. of other pairs very different and their joints disarticulating. Sess. spkts. subcylindric, callus long and often pungent with a barb of hairs; gl. i sub-cylindric or oblong; ii cymbiform or linear with a rounded keel in which the awn of iv lies, awnless; iii hyaline; iv reduced to the base (or base hardly any) of a long awn with a stout column. Pedicelled spkts. male or neuter, very different from the heterogamous sessile, often similar to the homogamous, more or less concealing the sessile; gl. i usually many-nerved; iv hyaline, awnless. Lodicules fleshy obcuneate-quadrate with depressed glabrous top.

1. **H. contortus,** *Roem.* Syn. Andropogon contortus, *L.*; Sauri, *M.*; Saiyu, *Ho.*; Sauri ghas, *S.*; Chorant, *Kharw.*; Kher, *H.*; Sukla (Sambalpur); Dauria, Sinkola, *Or.*; The Spear grass.

A tufted and usually densely gregarious grass, 1–3 ft. high on poor soils, often 5 ft. in valleys and rich soils, often fastigiately branched. Leaves somewhat glaucous 4–12″ by ·1–·2″, acute or obtuse, scabrid above and on midrib below, sometimes somewhat hairy, sheaths keeled and also sometimes hairy, ligule very small scarious truncate ciliolate.

Spikes on filiform peduncles 1·5–3″ without the awns, 4–6″ with the awns, clothed with spreading white tubercle-based stiff hairs from the outer glumes. Lower pairs of subsimilar spikelets 4–8, green, male or with 3 minute unfertile anthers. Sessile female spkts. ·2″ or together with the elongated brown-barbed pungent callus ·25–·26″. Gl. i with involute margins, scabrid, brown; ii with inflexed nerved margins.

Chiefly in the drier districts and disappearing towards Purneah and Cuttack, though found on the drier hills of Orissa. Champaran, common in the hills! Shahabad! Gaya! Monghyr Hills, *Kurz*, etc.! Chota Nagpur, all districts on the hills and open ground in the valleys, also in forests thinned by fires! Santal Parg., Rajmahal Hills, common! Mayurbhanj! Puri, drier hills! Angul! Sambalpur! Fl. Sept.–Dec. Fr. Oct.–Jan., but all the fruits may not become detached until March when the spike with the disarticulating lower joints and the homogamous spikelets still remain. Annual.

Nodes glabrous, rarely pubescent. Leaf-sheaths and base of leaves sometimes with long tubercle-based hairs. Homogamous sessile spikelet ·2″, callus glabrous, gl. i oblong-lanceolate or oblong, margins inflexed, keels symmetrically winged, many-nerved between; ii narrower with inflexed margins slightly ciliate, sharply acuminate; iii ⅔ths i, lanceolate with inflexed margins ciliate; iv ¼ to ½ i with few long cilia, hyaline, awnless. Ped. spkt. like the sessile, but gl. i is unsymmetrical having one inflexed margin and winged only on that side, mostly longer than the sessile (basal one often much shorter), ii more cuspidate exceeding gl. i; pedicels about half as long as the joint. The pedicelled heterogamous spkts. are subsimilar and male. Awn of female spkt. hirsute on the column scabrid above.

A well-known grass from its gregarious character and the annoyance of the pungent barbed fruits which penetrate the clothing and skin. It is much used for thatching and lasts longer than rice straw. The young grass is a fair fodder, the old grass is also used, but only because there is nothing better; it causes a reddish colour in the dung of horses, and sometimes severe ulceration (from the barbs) in the gums of horses and cattle. The awns, as in other similarly awned grasses, are very hygroscopic and by their contortions and the barbed callus serve to thrust the seed into the ground.

74. HYPOGYNIUM, *Nees.*

Spikes solitary, peduncled in the axil of a spathiform leaf-sheath: joints and pedicels slender, tops obliquely truncate. Sessile spikelets dorsally compressed; gl. i with inflexed or involute keeled margins; ii keeled, awnless; iii hyaline or 0; iv a simple awn. Pedicelled spikelets somewhat similar to the sessile, male or neuter, gl. iv 0, sometimes iii also absent.

1. **H. foveolatum,** *comb. nov.* Syn. Andropogon foveolatus, *Del.*

A tufted grass from a few inches high to 2 ft., simple or fastigiately branched above with very narrow, sometimes almost filiform acuminate leaves mostly somewhat hairy and ciliate near the base. Spikes 1–1·5″ long with very slender peduncles, often 3–6 peduncles each with its own proper very slender spathe from a single axil and frequently sharply geniculate just below the spathe, limbs and pedicels slender villous. Spikelets subequal, ·08–·14″ long, linear-oblong, often purplish. Gl. i of sessile spkt. mostly with a dorsal pit above the middle, keels scabridly hispid 3–5-nerved between the keels.

Behar, *J.D.H.*! Manbhum, *Camp.*, *Clarke*! Also Gamjam and probably therefore in Puri.

Sheaths near base of stem finely silky, upper shorter than the internodes (in *Hooker's* Behar specimen which is only 3″ high the internodes are scarcely developed). L. scaberulous beneath, ligule short truncate ciliolate. Sessile spkt.

gl. ii as long as i, acute, 3-nerved; iii much shorter glabrous; iv with awn ·5-·7″ long, the glume reduced to a faint margin at the base. Ped. spkt. with 2 glumes, i sometimes pitted, 5-nerved; ii 3-nerved.

75. DIECTOMIS, *Hack.*

Perennial grasses with linear leaves and solitary spikes. Peduncle in the axil of a spathiform leaf sheath. Limbs and pedicels bucciniform, the mouths with large teeth. Sessile spikelets laterally compressed with short callus. Gl. i applied to the edges and only as broad as the opening of gl. ii, keels marginal, margin very narrowly inflexed; ii cymbiform, much broader, long-awned; iii narrow hyaline shorter; iv 2-toothed with a long stout awn from the sinus. Pedicelled spikelet with a very large gl. i, which, with its flattened villous pedicel, conceals the inner sessile spkt.; ii and iii successively smaller, neuter.

1. **D. fastigiata,** *H. B. & K.*

An erect much fastigiately branched grass 1–2 ft. high, sometimes decumbent at base. Leaves 3–12″, narrowly linear, acuminate, scabrid with elongate acute ligule. Spathes 2–3″, linear. Peduncle short or long. Spike 1–2″, limbs compressed, densely bearded on the margins, shorter than the spkts., tips with 2 large teeth. Sessile spkt. ·18″ long; gl. i linear acuminate (sometimes appearing 2-cuspidate from the very thin hyaline centre between the keels), dorsally villous above; ii ·16″ long, ·04″ broad (without unfolding), tapering towards base, membranous, 2-fid with very slender awn, keel villous above; iii with ciliate margins; iv cymbiform, 2-toothed with awn 1·5″, stout. Pedicelled spkt. with gl. i ·3″ long, 2 strong nerves on the margins ending in cusps and about 11-nerved between, oblong acuminate with slender terminal awn; ii half as long and iii half ii, oblong hyaline.

Gya, *Mokim*! Ranchi, *Clarke*! Hazaribagh, *Clarke*! Manbhum, *Camp.*! Fl., Fr. Sept.–Dec. Perennial.

76. SCHIZACHYRIUM, *Benth.*

Stout or (in our area) very slender, annual or perennial grasses with linear leaves. Spikes solitary on the peduncle which is partially enclosed by a narrow spathiform leaf-sheath and is articulate at base of spathe. Limbs and pedicels of spikes clavate or bucciniform with cupular irregularly toothed or equally 2-lobed or -toothed mouths, rhachis articulate fragile. Spikelets sessile, and neuter imperfect pedicelled. Sessile spkt. dorsally compressed, callus short. Gl. i keeled; ii not or minutely awned; iii hyaline empty epaleate; iv hyaline 2-fid, awned in the cleft.

Divaricately branched. Spikes glabrous or sparsely hairy . . 1. *brevifolium.*
Fastigiately branched. Spikes pubescent and villous . . . 2. *exile.*

1. **S. brevifolium,** *Nees.* Syn. Andropogon brevifolius, *Sw.* (1788); A. parviflorus, *Roxb.*

A delicate much-branched straggling and ascending leafy grass 8–18″ high. Branches filiform. Leaves ·7–2·5″ suberect or divaricate linear or broadly linear obtuse or subacute. Spikes few to each

leaf-axil ·5–1″ long, each solitary in its very narrowly linear spathe with filiform peduncles, joints and pedicels glabrous or sparsely hairy, clavate oblique and hollowed at the tip, margin toothed or (usually 2-) lobed, bearded or not. Spikelet ·12–·17″ long. Gl. i coriaceous, tip 2-fid, ii acuminate or cuspidate; iv deeply 2-fid; awn ·3–·5″. Pedicelled spkt. reduced to a long-awned glume.

In dry low jungles. Purneah, on gravelly knolls, *Kurz*! Behar, *J.D.H.*! Monghyr, *Mokim*! Santal Parg., *Kurz*, etc. (Rajmahal Hills)! Ranchi, *Clarke*! Hazaribagh, *Clarke*! Manbhum, *Clarke*! Orissa, *Walsh*! Fl., Fr. Oct.–Dec.

L. glabrous except the margins and nerves which are scabrid beneath. *Hooker* states that the spathes are spreading, whereas in *exile* they are erect. The specimens do not always show this distinction.

2. **S. exile,** *Stapf.* Syn. Andropogon exilis, *Hochst.*

Very similar to *brevifolium* but branching much more fastigiate, leaves acuminate or very acute glabrous or sparsely hairy. Spikes 1–1·5″, joints pubescent and densely silkily villous towards the tips which have a long tooth or lobe each side. Sessile spkt. ·15–·18″ (·25″, *J.D.H.*), subulate-lanceolate. Gl. i coriaceous, dorsally villous, with very slender 2-fid apex; ii linear-lanceolate, 1-nerved, cuspidate or with a short awnlet; iv 2-fid, awn ·3–·7″ long. Pedicelled spkt. subulate silky, gl. i shortly awned.

Gya, *Clarke*! Hazaribagh, *Clarke*! Manbhum, in dry sunny places, *Kurz*, *Clarke*! Fl., Fr. Oct.–Dec.

The plant usually dries red. Upper spathes often aristulate. Spikes often concealed among the leaves.

77. ANDROPOGON, *L.**

(*Andropogon*, section *Arthrolophis* of *F.B.I.*)

Mostly perennial grasses of various habit. Spikelets 2-nate, the sessile and pedicelled differing from one another in sex and more or less heteromorphous, all pairs similar, or if the lowest sessile spkt. male or imperfect then resembling the others. Spikes (spiciform racemes) many-jointed fragile, paired (sometimes digitate and more than two, but not in our area) on terminal peduncles embraced below by a spathe-like leaf (spatheole), frequently 2 or more pairs with their spathes subtended by a common spathe and so on to more composite branching, the whole forming a panicle. Joints and pedicels slender, or stout, clavate or thickened upwards, tips more or less cupular or auricled. Glumes 4, membranous or somewhat chartaceous or subcoriaceous. Sessile spkts. gl. i flat or concave or channelled on the back, 2-keeled with sharply inflexed margins from the keels, at least from the middle upwards; ii subequal, cymbiform, keeled upwards, 3–1-nerved, sometimes awned; iii hyaline, 2-nerved, usually ciliate, empty; iv small hyaline 2-fid or 2-dentate with an interposed awn, sometimes reduced to the awn, palea small or 0. Lodicules glabrous. Grain narrowly lanceolate to oblong, subterete to plano-convex.

* This is only part of *Linnæus's Andropogon* and a very small part of the *Andropogon* of the *F.B.I.* and of *Hackel's* monograph. Following *Dr. Stapf* (*Fl. Trop. Africa*, etc.), the various sub-genera of *Hackel* have been restored to generic rank. These are *Schizachyrium*, *Diectomis*, *Hypogynium*, *Amphilophis*, *Sorghum*, *Vetiveria*, *Chrysopogon*, *Dicanthium*, *Cymbopogon*, *Heteropogon* and *Pseudanthistiria*, in addition to a new genus *Capillidium*.

Pedicelled spkt. more or less compressed dorsally, never concave dorsally, sometimes rudimentary.

Height 3-6 ft. Gl. ii of sess. spkt. awned . . . . . 1. *apricus.*
Height 8–15″. Gl. ii of sessile spkt. minutely cuspidate . . . 2. *pumilus.*

1. **A. apricus,** *Trin.*

Stems clustered 4–6 ft. high branched above. Leaves at base 1–3 ft. long, cauline, 10–20″ long by ·25″, pubescent or glabrescent beneath, thinly hairy on the nerves above, those on shoots pubescent or hairy. Branches with slender peduncles sheathed with a spathiform leaf-sheath and bearing geminate spikes 1–2·5″ long or (*fide J.D.H.*) in fascicled spikes of 3–5 (though I doubt whether this form occurs in our area). Limbs (or joints) and pedicels (of pedicelled spkts.) bucciniform with 2-toothed cupular apices and densely clothed with long hairs below on the margins. Sessile spkt. ·17–·2″ long, callus shortly bearded. Gl. i linear with margins strongly inflexed and centre deeply depressed between the keels, keels scabrid towards tip which is truncate or appearing 2-cuspidate or 2-aristulate when dry from the shrivelling of the delicate hyaline centre: ii cymbiform hyaline 1-nerved with fine awn ·12″ long; iv with awn 1″ or more from between the sparsely ciliate lobes.

Rather common in the open grass tracts in the forests of Chota Nagpur on the hills! Fl., Fr. Oct.–Nov.

Culms yellow. Ligule scarious oblong truncate ciliolate. Peduncles 2–4″ long numerous, forming a large false panicle, each spike shortly stipitate. Gl. iii of both spkts. narrow hyaline broadly ciliate. Ped. spkt. gl. i 2-cuspidate from the shortly excurrent keels and often with a fine scabrid awn ·25–·3″ long, keels ciliate; ii and iii as in sessile spkt.; iv shorter hyaline finely awned with 3 stamens and a 3-fid quadrate scale.

2. **A. pumilus,** *Roxb.*

A small tufted often gregarious grass 8–15″ high with narrow linear leaves 1–3″ long with few long delicate hairs near the base when young. Spikes ·5–·7″ long, geminate, secund, on slender sheathed peduncles, leaving each a cup-shaped clavately cupular 3-toothed 3-quetrous joint after falling, the peduncle itself also jointed below the spathe. Two–more peduncles arise from the axil of a spathiform leaf on a branch of a lower order and these from others, the whole forming a false panicle. Sessile spkt. ·15–·18″ dorsally compressed, callus united with that of the next upper joint and of the pedicelled spkt. rounded glabrous. Gl. i linear with 2 very strong keels each diverging and ending in small tubercles below, and in a short cusp at the apex, back of glume infolded between the keels, margins narrowly inflexed. Joints and pedicels equal 4–8 only, ·1–·12″ long, white bearded on the outer edge, much less on the inner edge. Ped. spkt. ·15″ (·17–·25″ *fide J.D.H.*!) with 3 stronger nerves and about 3 more slender nerves between, lateral nerves scabrellous.

Sambalpur (borders of the Central Provinces, Bilaspur! and Raipur!) Fl. Dec. Often red when mature and noticeable from this and its secund panicles. Sessile spkt. gl. ii chartaceous cymbiform as long as i, minutely cuspidate; iii ·12″ linear hyaline; iv about ·08″ long, scarcely more than the base of the awn, narrowly linear and with 2 capillary lobes; awn ·4–·3″ long slender. Ped. spkt. gl. ii nearly as long as i, scarcely keeled, 3-nerved; iii as long, hyaline, delicately 4-nerved, lanceolate, obtuse, stamens 3.

78. CYMBOPOGON, *Spreng.*

Perennial densely tufted and usually aromatic grasses with often coarse leaves and frequently much compound and contracted spatheate panicles. Spikes geminate, usually rather short, on a common peduncle supported by a spatheole; spatheoles variously arranged in racemes and panicles, each order of branching being in its turn sheathed by a more or less spathiform leaf. Joints disarticulating when mature. Spikelets 2-nate, those of each pair heterogamous and more or less heteromorphous except the lowest pair of one or both spikes which are homogamous (male or neuter).* Joints and pedicels filiform or linear with frequently more or less cupular or auricled tips, those of lowest pair (base of spike) often hard and swollen. Sessile spkts. (above the lowest) female or 2-sexual, dorsally compressed, callus very short, obtuse, shortly bearded; gl. i flat or slightly depressed or deeply grooved on the back, 2-keeled, margins, at least above, sharply inflexed and often winged; ii cymbiform, usually 1-nerved; iii entire, hyaline, oblong, 2-nerved; iv hyaline, 2-fid or -lobed or firmer below the insertion of the awn, column of awn smooth, lodicules minute, glabrous, st. 3. Grain oblong, subterete or plano-convex. Ped. spkt. strongly dorsally compressed, male or neuter, gl. i never depressed or grooved; ii thinner in texture; iii hyaline 2-nerved; iv 0 but usually a male flower present.

A. Back of gl. i of sess. spkt. not reduced to a narrow channel between the keels, sometimes partially grooved :—
  1. Joints of spikes and pedicels of spkts. with villi ·2″ long half concealing the sessile spkts. :—
    Panicle narrow with dense fascicles of branches. Spkts. ·2″ long . . . . . 1. *jwarancusa.*
  2. Joints of spikes and pedicels of spkts. shortly villous or ciliate :—
    Keels of gl. i of sess. spkt. winged, back flat with a partial median longitudinal cleft (usually below centre) . . 2. *Martini.*
    Keels of gl. i of sess. spkt. very narrowly winged or not, back flat or slightly depressed or concave without a cleft . 3. *nardus.*†
B. Back of gl. i of sessile spkt. reduced to a narrow channel between the prominent keels. Panicle odourless :—
  Tall. Panicle decompound. Channel between keels extending to the base . . . . . 4. *microtheca.*
  Height about 3 ft. Panicle not very compound. Base of gl. i with a boss extending partly between the two short forks of the channel . . . . . 5. *gidarba.*

1. C. jwarancusa, *Schult.* Syn. Andropogon jwarancusa, *Jones.*

Usually a tall grass 3–6 ft. high with very aromatic roots, densely tufted, the stems from clusters of firm persistent finally loose and open and tortuous leaf-sheaths, more or less widened below. Leaves flat up to 2 ft. long and ·2″ broad, narrowly linear, filiform above and ending in a long capillary tip, ligule ·02″ membranous. Panicles long narrow interrupted, with very compound short fascicled branches bearing spathes about 2″ long and spatheoles ·25–·75″ long. Spikes about ·5″ but unequal; spikelets 3–4 prs. half hidden by the ·2″ long villi of the joints and pedicels. Sessile spkts. ·2″ long, gl. i flat or

* But see remarks under *C. microtheca*, var.
† Note.—*Stapf* splits up *nardus* into several separate species.

concave between the keels, which are neither winged nor margined (*i. e.*, of course, omitting the ordinary inflexed margins of the glume common to the genus) or sometimes narrowly margined, scabrid or ciliolate, nerves 2–4 or 0 between the keels. Joints of rhachis and pedicels subclavate with toothed tips. Ped. spkts. equal or rather longer than the sessile, narrowly lanceolate, purplish, gl. i 7–9-nerved.

Patna, *Wall.* (No. 8793 *c*) ! Fl. April.

One of the Oil-grasses. See *Stapf* in *Kew Bulletin*, 1906. Patna is outside its normal distribution, but it was probably collected near the Ganges.

2. **C. Martini,** *Stapf.* Syn. Andropogon Schœnanthus, *F.B.I*; Sail tati, *K.*; Nanha-dudhi-ghas, *S.*; Rusa-oil grass.

A tall sweet-scented grass 5–8 ft. high with glabrous straw-coloured leafy-stems and flat usually broad leaves with a rounded or subcordate base, more or less glaucous beneath, those below the inflorescence rarely under 9″ long by ·4″ wide at the base but often 1″ wide below, tapering from a little above the base or from the middle to a fine tip, glabrous except for the scabrid margins, margins sometimes smooth near the base. Geminate spikes ·5–·75″ long oblique or divaricate or less often deflexed. Peduncle about half the length of the ·75–1″ long spatheole, several spatheoles and their peduncles from a spathe of a lower order, these arranged in long usually narrowly oblong panicles not more than 1·5–2″ wide, but sometimes panicle with many branches and broader. Joints and pedicels slenderly clavate (exc. the much thickened lowest) about ½ sessile spkts., tips with lanceolate tooth or 3-toothed, margins long-villose. Sess. spkt. ·15–·2″ long, gl. i (above the lowest spkt.) with lanceolate centre becoming oblanceolate or oblong from the keels being membranously winged above the middle, back with vertical median depression below middle corresponding to a ridge on the inside; ii cymbiform with the dorsal keel winged above, minutely ciliate below.

Chiefly on rocky hills with sparse forest. Monghyr, *Mokim* ! Gaya, common on the ghats ! Santal Parg. and Chota Nagpur, all districts, common, ascending to the top of Parasnath, chiefly in the valleys and on the northern or shady sides of the hills, locally abundant ! Angul ! Sambalpur ! An undoubted perennial (*Hooker* says "annual ?") forming buds in the autumn from a thick nodose root-stock. Fl., Fr. Oct.–Dec.

3. **C. nardus** *L.** Syn. Andropogon nardus, *L.*

A tall grass 5–7 ft. high copiously branched above and forming a large decompound nodding panicle. Culms up to ·4″ diam. at the base, solid, pale polished, with black finely pubescent or glabrescent nodes. Leaves narrow with conspicuous white midrib, lower several feet long and about ·6″ wide, upper cauline rarely over ·35″ wide, narrowed to the base, apex filiform, glaucous beneath, glabrous except sometimes at top of sheath, with scabrous margins; ligule scarious ·08–·1″ long glabrous or ciliate. Panicle ultimate branches strict with 2–3 peduncles and spathules from each spathe. Spathules ·4 to about ·1″, peduncles of spatheoles filiform ·5–·7″ very shortly exserted from the spathe; spikes soon strongly reflexed on their common ·4″ long peduncle, base swollen ciliate. Spikes ·4–·5″ long unequally pedi-

* This is not *C. nardus* according to *Stapf* who confines that species to the cultivated awnless plant.

celled, joints and pedicels rather slender ·08–·09″ not clavate (tip only dilated and toothed), villous. Sessile spkt. not tightly squeezed between joint and pedicel nor covered by their hairs, ·15–·2″ long, gl. i oblong-lanceolate flat or slightly concave below, hyaline and nerveless or with 2 green nerves between the keels which are not or very narrowly winged above the middle, scabrous and slightly excurrent, proper margins inflexed throughout.

In the northern area chiefly. One of the commonest savannah grasses in Purneah! N. Champaran! Santal Parg., *Mokim*! Monghyr, *Mokim*! Fl., Fr. Sept.–Dec. Perennial.

Var. α. **flexuosus,** *Hack.* (*? flexuosus* is supposed to be South Indian only).

Tall with very decompound panicle and slender erect often flexuous branches. Outer spathes 1·25″, but much larger and foliaceous on main branches. Spikes unequal, about ·4 and ·5″ respectively in spatheoles about ·7″ long. Longer spike subsessile with the lowest pair of spikelets homogamous and the sessile spkt. nearly resembling the pedicelled one ·16″ long, and its gl. ii not cymbiform, iv 0. Other sess. spkts. ·2″, gl. i strongly 2-keeled ending in 2 small cusps above, keels scaberulous towards tip and rather broader but not winged, margins narrowly incurved throughout, back pale flat nerveless (or 2 very obscure nerves); ii cymbiform, its keel well developed and scabrid above but scarcely winged, tip acuminate; iii ·17″ hyaline, ciliate; iv narrow-linear ·08″, 2-toothed and sparsely ciliate at tip with a fine awn ·18–·2″ long. Grain terete ·1″ long.

This is common in Purneah and the Duars. The joints and pedicels are slender with cilia ·05–·08″ long. Leaves ·25″ broad.

Var. β. **grandis,** *Hack.* The following description is from the *F.B.I.*:—

Tall, stout, L. 2–3 ft. long by ·3–·5″ wide. Panicle narrow, loosely branched, branches distant often drooping, outer spathes 1·5–3″, spatheoles 1–1·2″, joints and pedicels shortly ciliate, sessile spkts. ·17–·2″ long, oblong-lanc., obtuse, dorsally flat or slightly concave below, keels margined or winged above the middle, nerves obscure, keel of ii sometimes shortly winged above the middle, lobes of gl. iv ciliate, awn ·3–·5″.

Rajmahal, *Mokim*! (This was the specimen seen by *Hooker*.)

Var. γ. **microstachys,** *Hook. f.*?

Culms pale with dark nodes. L. 15″ by ·4″, glaucous beneath, tip filiform. Panicle rather strict with very long slender erect branches with numerous sheaths bearing several peduncles, some again branched. Spatheole ·4″, spikes divaricate and reflexed ·5″ or less with about 3–4 prs. spkts. only. Joints and pedicel ·08–·09″, cilia up to ·06″ long. Sess. spkt. ·14–·15″, gl. i 2-keeled, oblong lanc., with 2 very distinct green nerves between the keels, dorsally flat, keels slightly excurrent, narrowly winged or margined above the middle and scabrous; ii with scaberulous keel, inflexed margins softly ciliate; iv ·08″ 2-fid with filiform segments, awn ·25″.

Champaran, common! This may be *A. nardus* proper of *F.B.I.*, but the spikes and spikelets are very small. It differs from var. *microstachys* in the denser decompound panicles and prominent nervation of gl. i.

4. **C. microtheca,** *Hook, f.* Var. sameshwarensis.

Tall 4–5 ft., nodes dark-coloured or not. Upper leaves 15″ by ·2″ with scabrellous margins and marginal nerves and sometimes scabrellous above on all nerves, somewhat silky above the scarious ·07″–long ligule. Panicle decompound odourless. Spatheoles ·4–·5″ finely acuminate or sub-aristulate, two to four very shortly exserted from a spathe not much exceeding them which has the peduncle bearded on one side near the pale swollen tip and is often subaristate. Spikes very short ·3″ or less, strongly reflexed on their very short common peduncle which is also ciliate on inner side and under ·5″ long, base of spikes long-ciliate, joints and pedicels ·07–·08″ long slender gradually wider upwards, toothed (mostly with one large and 2 smaller teeth).

Sessile spkts. ·13″ long fitting between the joint and pedicel the hairs of which fringe its glume i on either side. Gl. i deeply channelled to base between its nearly glabrous minutely excurrent keels, margins much inflexed, not at all winged ; ii rather shorter cymbiform mucronate, keel scabrous ; iv very narrow, 2-fid with capillary segments about one-fourth of its length, awn about ·25″ long only.

Ramnagar Hills, Champaran! Common. Fl. Oct.

The deeply channelled glume i with the 2 keels approximate make this easily recognizable from any form of *C. nardus*. It differs, however, in some other respects almost as much from *C. microtheca*. Both have one spike of the pair pedicelled and all pairs of spkts. similar, and the other spike sub-sessile with the lowest sessile spkt. not differing much in appearance from the others, but lacking gl. iv and with a very minute palea (or rudimentary gl. iv) and rudimentary ovary (they are therefore in floral characters as near section *Piestium* of *Andropogon* as to *Cymbopogon*). The joints, however, especially the lowest of typical *microtheca*, are ·04-·05″ long and much swollen, so that they are nearly as broad, one edge (that adjacent to the sess. spkt.) is villous, the other more rounded edge minutely villous, the joints are deeply excavate above and 2-toothed on the margin. In our variety the corresponding lowest joint (subtending the persistent imperfect sessile spkt.) is only ·03″ long and narrowly trumpet-shaped, *i. e.* not at all swollen, both edges are nearly equally villous. Both have the very rudimentary 2-lobed glume iv (or palea) in the imperfect sessile spkt. and this is only about twice the length of the lodicules. I have found no stamens but an imperfect ovary, so that the lowest pair of spkts. is *not homogamous*, the adjacent pedicelled spkt. having 3 well-developed stamens.

5. **C. gidarba,** *comb. nov.* Syn. Andropogon Gidarba, *Ham.*

Slender 2–3 ft. high with glabrous nodes. Leaves very narrow ·1–·2″ broad, puberulous or shortly hairy above, glaucous beneath, ligule scarious appressed to the culm, ·1″ long glabrous. Panicles strict erect. Spatheoles ·6–1·2″ long convolute subcuspidate glabrous, their peduncles compressed, peduncle of geminate spikes about one-third to half as long as spatheole not or shortly exserted, tip slightly toothed. Spikes unequal and with unequal bases, the one with the longer base heterogamous throughout, the more sessile one with lowest sessile spikelet differing from the others and male. Joints and pedicels rather stout, basal sometimes very stout, flattened and concave sometimes even conduplicate and embracing the lowest sessile spkt. on one side, often purple and hirtellous, tops toothed and slightly ciliate. Sessile spkts. wedged in between the joints and pedicels the hairs of which do not conceal its gl. i (cp. *C. iwarancusa*), callus glabrous or nearly so. Gl. i ·13–·14″ long, deeply channelled from one-third of its length above the base, the channel slightly forked below, strongly 2-keeled with broadly inflexed margins, not at all winged, oblong-lanceolate, keels scaberulous, scarcely excurrent, not nerved between. In most spkts. there is a deep pit in the callus at the base of gl. i.

Monghyr, *Ham.* (*Wall.* n. 8797)! Gya, *Mokim*! Hazaribagh (Koderma Forest)! Fl., Fr. Oct.–Nov. Annual.

79. THEMEDA, *Forsk.*

(*Anthistiria, L.*).

Tall annual or perennial grasses with narrow leaves and short ligules. Spikelets 3-morphic, in clusters with the 4 outermost forming

an involucral whorl or sub-whorl round the inner: inner in a central spike on a very short internode to which it is obliquely articulate. Central spike of 1–3 sessile 2-sexual (or female) spikelets each with a pedicelled male or neuter spkt. or terminal (or if only one) with 2 pedicelled spkts. Clusters shortly peduncled in the axil of a proper bract or spatheole. Spatheoles in spathaceous panicles, the partial panicles often fascicled. Involucral spikelets male or neuter, awnless with 3–4 glumes. Sessile 2-sexual or fem. spkts. with oblique often pungent barbed callus, gl. i subterete, convolute round the inner except the keel of ii, coriaceous, finally hardened; ii as long, coriaceous with broad keel which receives the awn of iv; iii hyaline, 1-nerved; iv reduced to the hyaline base of the awn, or sometimes awnless, palea 0. Lodicules more or less cuneate, often large. Anthers large. Grain oblong. Pedicelled spikelets dorsally compressed with 1–3 glumes, i many-nerved, embracing the others which are hyaline.

I. Grasses 4–7 ft. high. Invol. spkts. in a symmetrical whorl (exc. sometimes in *strigosa*), glumes 3:—
  A. Sessile spkts. only one in the spike. Gl. i of involucral spkts. not uniformly covered with tubercled setæ:—
    1. Branching strict. Clusters very numerous in numerous fascicles:—
      Perennial, erect. Clusters in globose or fan-shaped drooping spatheate fascicles. Invol. and sessile spkts. mostly over ·25″ . . . . . 1. *imberbis*.
      Annual, erect or scrambling. Clusters or fascicles in erect or suberect racemiform partial axillary inflorescences or very close at the ends of the branches. Invol. and sessile spkts. under ·25″ . . . . . 2. *quadrivalvis*.
    2. Branching very effuse. Clusters very few in few small superposed fascicles on the filiform branches . . 3. *laxa*.
  B. Sessile spkts. 2-3 in the spike. Gl. i of invol. spkts. densely-covered with tubercle-based setæ. Invol. spkts. about ·17″ long . . . . . 4. *strigosa*.
II. Grasses 6–20 ft. high. Invol. spkts. with two of their number on a higher level than the other two, glumes 4:—
  Invol. spkts. scabrellous or nearly glabrous. Sessile spkt. densely brown appressedly hirsute . . . . . 5. *caudata*.
  Invol. spkts. covered with long spreading tubercled-based yellow hairs. Sessile spkt. not densely hairy . . . 6. *arundinacea*.

1. T. imberbis, *T. Cooke* (partly). Syn. Anthistiria imberbis, *Retz.*

A usually tall tufted grass 2–7 ft. high. Stems terete or compressed, yellow polished. Leaf sheaths below loose open often ·5″ wide (when laid out flat), upper much compressed and keeled, polished smooth, leaves very narrow 12–15″ by ·15–·25″ tapering to a point from a little above the base which has sometimes a few slender villi, margin and midrib beneath minutely scabrous; ligule scarious often torn, ·05–·1″ long glabrous. Panicle leafy slender, very lax with main rhachis minutely scabrid below the leaves. Partial panicles (those in the axils of the leaves) never spiciform, consisting of fan-shaped fascicles or a system of fan-shaped fascicles with a leaf-like bract subtending a fascicle and 1–3 short capillary naked branches each of which in its turn bears a leaf-like bract and a fascicle or a further system. Bract-leaf subtending the fascicle 1–3″ long with sheath glabrous or with a sub-marginal row of tubercle-based bristles, its peduncle more or less pubescent or scabrid and with a short beard

on one side of the swollen tip. Fascicles consisting of a much abbreviated thickened axis with many barren bracts and several spike-bearing bracts (spatheoles) of various ages. Spatheoles always glabrous, ·5–·8″ long cymbiform acuminate with scarious margins and scabrellous keel, very shortly stipitate and bearing in its axil the minute stipes ·02–·07″ long of the cluster. Involucral spikelets ·25–·35″ long, 4 in a complete whorl, their slightly thickened calli contiguous. Involspkts. gl. i oblong 2-keeled with inflexed margins and one or both margins with a hyaline wing (sometimes 2 with both margins and 2 with one margin winged), back more or less setose but bases of hairs scarcely tubercled, tubercles mostly on the keels, few (hairs deciduous and more noticeable on the very young involucres). Bisexual spkt. usually only present in the young involucres, solitary, terete ·25–·3″ long (including the callus) on a very short flattened glabrous joint from which it separates with an oblique scar, the callus being at first wedge-shaped ultimately more pungent and with a barb of long brown hairs up to ·15″ long somewhat unilateral; gl. i pale below and quite smooth ultimately deep brown, upper third or fourth brown and scabrid, tip truncate, about 9-nerved; ii as long, narrow oblong with rounded keel which receives the awn, 1-nerved in centre and 2–3-nerved in each margin; iv reduced to the long awn which is 1·2–2″ long, its base filiform, column brown or black hispid and arm scabrous. Ped. spkts. caducous, very unequal, ·12–·28″ long, linear acuminate, glabrous.

2. **T. quadrivalvis,** *O. Kuntze*. Syn. Anthistiria ciliata, *L. f.*

A rather stout, usually gregarious, grass 4–6 ft. high with several stems often geniculate at the base, usually terete, ·15–·2″ diam. between the nodes, lower sheaths mostly lax and open, upper keeled, ligule scarious usually lacerate ·05–·1″, blade rarely over ·25″ wide, scabrellous on margins or those on inflorescence with bristly margins, occasionally some leaves with tubercle-based bristles, glaucous beneath. Panicles mostly dense with the leaves not much longer than the partial inflorescences. Partial inflorescences (in the axils of the leaves of main rhachis) racemiform and paired erect or suberect or cernuous 1·5–3″ long, close and almost forming a thyrse at the ends of the stems, with slender shining peduncles. Each partial inflorescence with subdistichous or spiral erecto-patent bract-leaves 2·5–1″ long and ·1″ wide with a short sheath clasping the rhachis and bearing in its axil a series of peduncled spatheoles, the lower also a branchlet which in its turn bears spatheoles and perhaps another branchlet. Bract-leaves often with tubercled bristles on margin chiefly near the base of blade and mouth of sheath, their peduncles clavate but not bearded at tip. Spatheole conduplicate lanceolate finely acuminate, keel scaberulous. Involucral spikelets ·17–·18″ long; gl. i oblong or lanc.-oblong sub-spinulose-tipped, with tubercle-based bristles chiefly near the top, about 9-nerved, keels scaberulous, one sometimes slightly winged. Bisexual spikelet solitary ·18″ long (with callus), callus articulating obliquely to the minute flattened pedicel, barbed with long brown hairs; gl. i often clothed uniformly with sparse very short

appressed hairs but lower hairs usually deciduous (sometimes leaving microscopic dots) and then only tip hispidulous as in *imberbis*. Pedicelled spkts. with gl. i narrowly linear but flat (it usually remains convolute in *imberbis*).

Commonest on laterite and on cotton-soil but not nearly so abundant as in the Central Provinces where it frequently takes possession of whole acres of cotton soil. Santal Parg., *Gamble*, etc.! Gya, *Mokim*! Ranchi, very common at Neterhat on laterite! Palamau, frequent! Singbhum, not very common! Manbhum! Angul to Sambalpur, frequent! Fl. Oct.–Dec. and sometimes up to May. Annual.

The bract-leaf subtends a shortly pedunceled spatheole or branchlet; in their axil each of the spatheole-peduncles in turn is subtended by a sessile hyaline bract and contains in the axil the next younger spatheole without evident internodes. Some of the peduncles are subtended by two hyaline bracts, the last spatheole in the axil of the previous spatheole-peduncle and its bract is the youngest.

In one form among bushes the stem is weak and clambering.

3. **T. laxa,** *Stapf* (in *Kew Herb.*). Syn. Anthistiria laxa, *Anders.*; Tatian, *Vern.*

A very distinct species in the field, being a tufted slender much branched and feathery grass 2–4 ft. high, feathery from the very numerous short soft narrowly linear leaves, and with many lax leafy panicles of sub-solitary or few (3–4) small heads one over the other in verticilliform clusters on the filiform branches. Lower leaves on main stem up to 12″, upper 2–4″ by ·1″ ending in a filiform tip, with few long white soft hairs near the base, sheaths compressed striate, keeled. Heads about ·5″ diam. Spikelets of involucre ·2–·25″, often reddish, with green glabrous callus; gl. i narrowly oblong, tip almost spinulosely acute, nerves 9–11, distinct, back with scattered tubercles each with a long white hair, chiefly in upper half and sometimes very few. Central spike with one sessile spkt. ·18″ long (including the bearded callus) and 2 pedicelled spkts. ·2–·25″ long tapering at base into the short (·04–·05″) pedicels. Upper fourth of gl. i of sess. spkt. closely scabrid-hispid.

This common Central Provinces grass (*C. P. List*, p. 264) barely enters our area in its gregarious state but isolated specimens occur in Sambalpur! Porahat division (Singbhum)! Fl. Oct.–Nov. Fr. Dec., when the clusters usually turn red.

Ligule 0. Spatheole long-acuminate, very narrowly cymbiform, 1–1·5″, hispid-scabrid on margins. Involucre spkt. gl. ii ·22″ with a fine median nerve and 2–3 nerves in each margin, margins narrowly inflexed, ciliate; iii as long, hyaline, lodicules cuneate, micro-ciliate on the truncate end; iv apparently sometimes present (or a minute palea) and sometimes a rudimentary ovary. Sessile spkt. gl. i truncate, obscurely 9-nerved; ii narrow, longer, with incurved margins and rounded keel which receives the awn of iv; iii hyaline, linear, rather shorter than i (about ·12″); iv reduced to hyaline base of nearly smooth awn 1·2–1·5″ long; lodicules very large, ·03–·04″ long, oblong-obcuneate. Ovary linear-oblong. Ped. spkt. very narrow, very sharply acute, gl. i many-nerved, ii scaberulous on keel, margins ciliate inflexed.

The grass is a very poor fodder.

4. **T. strigosa,** *comb. nov.* Syn. Anthistiria strigosa, *Ham.* (*F.B.I.*).

A leafy grass about 4 ft. high with compressed and keeled glabrous polished leaf-sheaths, leaves ·1–·17″ wide with scabrid margins, ligule under ·05″. Panicle very compound with long slender upright branches, 2–3 branches from a leaf axil leafless for 1–3″, then with a leaf-bract bearing 2–several spatheoles and often a further slender

branchlet which may be again similarly branched. Spatheoles and their spikes not hidden among the bracts (as in *imberbis* and *ciliata*). Spatheoles strongly-nerved or -ribbed, ·4–·5″ long ciliate or not at the keel, subaristate, geniculate and bearded on the peduncle. Involucral spkts. about ·17″ long sometimes two higher than the other pair; gl. i oblong-lanceolate closely covered with tubercled setæ, many-nerved; ii as long subaristate; iii narrow colourless. Bisexual spkts. usually 2, pale, ciliate on the callus with pale hairs, ·13–·15″ long; gl. i hispidulous above; ii wrapped round the slender ·3–·5″ long awn; ped. spkts. usually one to the lower and 2 to the upper 2-sexual spkt. on glabrous ·05″-long pedicels, gls. i and ii ·17″, i with tubercled bristles, lanceolate, aristately-acuminate; st. 3.

Purneath, frequent! Monghyr, *Mokim*! Fl., Fr. Oct.–Dec. Annual.

A very distinct species. The involl. spkts. are usually described as inserted on a level which mine are not.

5. **T. caudata,** *Dur. & Jack.* Syn. Anthistiria gigantea, *Cav.*; subsp. caudata, *Hack*; Anthistiria caudata, *Nees.*

A very large cæspitose grass from a stout rootstock with flattened stems 10–20 ft. high and leaves markedly equitant below 3–5 ft. long by ·3–·75″ broad with scabrid margins. Spikes with their spatheoles on slender peduncles in very large spatheate and leafy drooping panicles, the whole top of the plant being converted into a compound panicle, with pendulous spikes. Peduncle of spike about half as long as the spatheole, slender, long-pilose upwards. Central spike with 2–3 sessile spkts., the terminal with 2 ped. spkts. Sessile spkts. ·4″ long, densely hirsute with appressed dark brown hairs; awn 1·7″ long, dark-brown, scaberulous, but often absent (caducous ?).

Not uncommon in ravines and on the higher ghats, in the forest on the higher plateaux and mountains. N. Champaran, common at low elevation. Singbhum! Ranchi! Palamau, Neterhat (3000 ft.)! Hazaribagh, on Parasnath (4000 ft.) *Clarke*, etc.! Manbhum, on the Tundi Hills, *Camp.*! Fl., Fr. Sept.–Dec.

Culms greenish-yellow, or pinkish. Petioles compressed, deeply grooved above with very scabrid edges, blade glaucous beneath. Spatheoles 1·5–2″ narrow and finely acuminate, many-nerved, glabrous, on slender peduncles enclosed with others and a branch in a spathe, these with other peduncles and branches in spathes of a lower order and so on. Involl. spkts. ·4–·6″ long in somewhat unequal pairs, one pair with longer calli than the others, one of each pair apparently often empty, the other spkt. staminate, gl. i long subulate sub-aristulate, one margin much inflexed and its keel scantily ciliate and scabrid, back flat scabrellous, about 9-nerved; ii about ⅔ths i, 3-nerved and an additional nerve in margins, scaberulous; iii and iv sub-similar, ciliate, hyaline. Anthers nearly as long as glume (·3″). Central spike obliquely articulate on very short internode with brown hairy sides; sessile spkt. with oblique, densely brown-bearded, ultimately pungent callus, falling with its joint (·12″ long) and pedicelled spkt., gl. i very coriaceous nearly covering ii, 11-nerved (best seen from inside); ii with hirsute keel and involute coriaceous margins; iii and iv ⅔ths as long thinly brown-hairy, lodicules very large oblong-lanceolate, ·06″, 2-cuspidate. Grain free oblong brown, ·14″ long.

The grass becomes a pest from its ripe pungent glumes.

6. **T. arundinacea,** *Ridl.* Syn. Anthistiria gigantea, *Cav.*; A. arundinacea, *Roxb.*

A very handsome grass 10–20 ft. high with polished yellowish culms up to ·5″ diam. below, more or less elliptic in section with very compressed keeled leaf-sheaths of the same colour when old. Leaves on

the panicle only ·1–·15″ broad, setaceous tipped. Panicle mostly erect with inclined branches, the numerous golden yellow horizontal clusters appearing to be arranged in more or less vertical rows on the erect branches. Peduncle of clusters very shortly hairy or pubescent towards tip. Invol. spkts. staminate ·5–·75″ long, covered with beautiful golden or deep-yellow spreading bristles with tubercled bases. Gl. i spinulosely acuminate. Sessile spkts. ·45″ with long pungent callus bearded with brown hairs, gl. i thinly hairy below, above hispid or scabrid. Awn 3″ long. Ped. spkts. ·4–·6″ long, with long yellow bristles.

Purneah! Ranchi (at Neterhat, 3000 ft.)! Seemah forest, Palamau, 2500 ft.! Fl., Fr. Oct.–Dec.

80. ISEILEMA, *Hack.*

Annual or perennial not large grasses with slender compressed many-noded stems usually from a basal persistent tuft of leaves. Leaves narrow or very narrow; sheaths compressed, keeled, shorter than the internodes. Spikelets in clusters resembling those of *Anthistiria* with a whorl of outer involucral male or neuter spikelets dorsally flattened with short pedicels (or long callus) and a very short central internode bearing a central spike of one, rarely 2, sessile spikelets and their pedicelled companions. Differing however from *Anthistiria* in that the whole cluster is articulate below the involucre and the central spike is not articulate on the minute internode but falls together with the involucral spikelets; pedicelled spkts. separately articulate. Clusters on short peduncles in the axils of spatheoles, leaving a saucer-shaped disc at tip of peduncle on fall of cluster. Spatheoles few to many in the axils of spathes and these sometimes together with branches in the axils of spathes or leaf-sheaths of a lower order, but in general the branching less compound than in *Anthistiria*. Involucral spikelets with 2 or 3 glumes; i usually strongly nerved; ii thinner 1–3-nerved; iii, if present, narrow hyaline; anthers yellow or purple. Sessile spkt. lanceolar or bottle-shaped in outline; gl. i narrowly truncate or minutely 2-cuspidate (from the excurrent keel nerves); ii keeled with the keel lying between the pedicels; iii hyaline; iv reduced to membranous base (2-fid in *Holei*) of its awn. Ped. spkts. usually slender, male or neuter.

The spikelets or clusters are not pungent and their dispersal is by the wind.

I. Tubercles not present on the spatheoles or spikelets (rarely few present in *anthephoroides*). Nodes of stem not bearded:—
  Invol. spkts. with pedicels as broad as long, gls. 2. Sess. spkt. pubescent on lower half dorsally . . . . . 1. *anthephoroides.*
  Invol. spkts. with slender pedicels, gls. 3. Sess. spkt. glabrous on lower half dorsally . . . . . 2. *laxum.*
II. Tubercles or granules present on most of the spatheoles or on the margins of gl. i of the spkts.:—
  Clusters not in dense fascicles. L. ·1–·15″ wide. Peduncles often exserted beyond spatheole. Invol. and sessile spkts. subequal ·16–·18″ long . . . . . 3. *Wightii.*
  Clusters in subglobose fascicles. L. ·2–·25″ wide. Ped. hardly any. Sessile spkt. much longer than involucral . 4. *Holei.*

1. I. anthephoroides, *Hack.*

A much tufted grass, very leafy below, with many stems 1–2·5 ft. high sometimes pink, nodes glabrous. Leaves mostly short, longer about 5″ by ·16″, sub-obtuse, ciliate at base and tip of sheaths, cilia with small tubercle-bases, blades with scabrid margins, nerves usually fine and uniform; ligule of short fine hairs. Panicles long, rather strict, but some of the spatheoles divergent, lower spathes foliaceous, upper with shorter blades, base of blade and top of sheath with very long cilia. Spatheoles cymbiform not acuminate, smooth and glabrous or minutely tubercled and scaberulous, margins scarious, several spatheoles from each spathe or leaf-sheath. Peduncle of cluster very short ·1–·2″, invol. spikelets broadly oblong ·17″ long, rounded at tip, their pedicels ·04–·05″ long and nearly as broad at top, compressed, glumes 2 only. Central pedicel slender ·02–·03″ long only. Sessile spkt. ·2–·22″ long, the suddenly tapering part or beak rather longer than the lower broader part; gl. i hispid-hairy on the back on the wider portion, the beak scabrid or scabrellous.

Angul! Probably also Sambalpur, as it is frequent in the Central Provinces! Fl. Oct.–Nov. Perennial? (*Hole* thinks annual).

Spathes often with many tubercles on the margins. Clusters scantily bearded at the base. Invol. spkts. not or very sparsely, ciliate, pedicels bearded, gl. i with narrowly inflexed margins, strongly 3-nerved on the back and almost sulcate either side of midrib, 2 other partial nerves between the strong ones; ii nearly as long, flat, oblong, obtuse, 1-nerved; anthers ·09″ yellow. Sess. spkt. 2-cuspidate at tip, 4-nerved between keels; ii as long, narrowly lanceolate with prominent ciliate keel on lower third, scabrellous above, margin inflexed; iii very narrow, 2-nerved, ciliate; iv awn ·5–·55″ long, very slender, nearly smooth.

2. I. laxum, *Hack.* Mushan, *Vern.*; Panda-suali, *Or.*

Erect or suberect 1–3 ft. high with many weak stems from a tuft of radical leaves, base of stems covered with loose dry glabrous sheaths, nodes (at least the lower) glabrous. Leaves up to 7″ by ·15″ rarely larger, acute, sometimes with a few long hairs or cilia towards the base, margins scabrellous; ligule very short, membranous shortly ciliate. Panicles long slender very strict, spathes distant, erect with several spatheoles and clusters. Spatheoles smooth and glabrous, or scabrellous on keel, margins often hyaline, ·3–·45″ long. Peduncle scarcely exserted ·1–·2″ long only, slender, ending in a concave disc from which the cluster falls. Base of cluster white-bearded. Pedicel of invol. spkt. ·02–·04″ only, and about half as wide. Invol. spkt. glumes 3; central pedicel slender ·04–·07″ with scattered erect long white hairs to top but callus of sessile spkt. not bearded. Sess. spkt. ·17–·2″ long, tapering from about half way up and base rather contracted, gl. i depressed dorsally and smooth and polished below, upper half minutely scabrellous or keels almost scabrid.

Especially on cotton soil. Gya, *Mokim*, frequent! Manbhum, *Clarke*! Orissa, *Walsh*! Perennial (always?). Fl., Fr. Oct.–Jan.

Branches of inflorescence sometimes bearded at the nodes (base of spathes or spathaceous leaf-sheaths), lower spathes passing into leaves. Cluster (from base of involucre to tip of ped. spkt.) ·3–·35″ long. Invol. spkt. narrow-oblong ·15–·2″ long, obtuse or sub-truncate, strongly 3–5-nerved and with 1–2 weaker nerves each side, keels with erecto-patent white cilia, back minutely scabrellous; ii subchartaceous, as long, acute; iii hyaline very narrow about two-thirds i; anthers brown ·1″ long. Sess. spkt. gl. i narrowly truncate or appearing minutely

2-cuspidate (from the hyaline intermediate tissue disappearing) at the tip; ii acuminate, chartaceous, with the keel lying between the slender minute hairy or delicately ciliate ·07–·08″-long pedicels. Ped. spkt. separately deciduous ·17–·2″ long, slender, acuminate, strongly 3-nerved and scabrellous. St. brown or yellow.

This is one of the best Indian fodder-grasses for both horses and cattle.

Forma **ciliatum.** This has the leaves much more ciliate and scabrid, and is as leafy as *anthephoroides*, the cilia have small tubercles at their base. The invol.-glumes and pedicels are rather wider than usual but the pedicels are relatively longer than in *anthephoroides*, the callus of the sessile spkt. is bearded but the glume i is as in *laxum*. Puri!

3. I. Wightii, *Anders.*

A tufted very leafy, almost feathery grass, 1–3 ft. high, nodes bearded. Leaves very slender up to 9″ by ·1–·15″ rarely more, finely uniformly nerved, or 4–5 nerves each side stronger, margin scabrid or sub-spinulose as also is midrib beneath, sheaths usually with some sparse white hairs, top of sheaths and base of blade often setose with tubercle-based hairs. Panicle very leafy or not, spathes and spatheoles tubercled on keel and margins, spatheoles divergent ·4–·5″ long, peduncles of clusters shorter than spatheole or far exserted, minutely pustulate towards the end as often are the branches below the spathes. Base of clusters villose. Invol. spkts. ·16–·18″ long on pedicels ·02–·04″ long and much narrower, glumes 2, staminate or neuter, tip narrowly truncate, midrib and margins usually minutely tubercled and also often sparsely white-ciliate. Central pedicel about as long as involucral, with sparse white erect hairs. Sessile spkts. sometimes 2, with a joint ·06″ long, callus sometimes bearded, lower spkt. if 2 about ·13″ long, if solitary ·17″ long, lanceolar acuminate in outline as in *laxum*, gl. i dorsally smooth below, minutely scabrid or hispid above, tip narrowly truncate.

Usually on damp ground. Singbhum, common! Ranchi, *Wood*! Manbhum, *Clarke*! Hazaribagh, *Clarke*! Fl., Fr. Aug.–Dec. Perennial.

Invol. spkt. gl. i strongly 5-nerved, altogether 7-9-nerved, sulcate when dry, narrowly oblong, truncate, midrib and margins usually pustulate with minute red tubercles, inflexed margins embracing ii; ii as long, 1-nerved, anthers ·07″ long black. Sessile spkt. gl. i medianally depressed or nearly flat, about 2-nerved above between the keels; ii as long scabrellous on keel; iii linear hyaline truncate; iv awn ·5″ slender glabrous. Ped. spkt. ·17″ long, the pedicels as long as joint; lower about ·06″, upper ·03″ where there are two sess. spkts.

The grass is a fair fodder.

4. I. Holei, *Haines.*

A robust species 3–4 ft. high with much compressed polished stems up to ·2″ diam. densely bearded at the nodes. Leaves erect 8–16″ long by ·25″ broad, glaucous beneath, glabrous or villous near base, margins spinulosely scabrid; sheaths with very prominent keels, mouth ciliate; ligule very short truncate hairy. Panicle nearly leafless with erect branches, partial inflorescences with subglobose fascicles of spathes, spatheoles and small subsessile clusters. Spatheoles about as long as the cluster, ·25–·3″, red, tubercled or not on keel, peduncle of the cluster ·05–·07″ long, tip saucer-shaped. Cluster villous at base, red (in our specimens). Involucral spkts. narrowly elliptic-oblong ·12–·15″ long on slender pedicels ·015–·03″ long, acute or mucronulate, glumes 2, stamens 3. Central pedicel as long as involucral and callus white-ciliate with long hairs; sessile spkt. ·2″ long, lanceolar or linear-

lanceolar in outline, gl. i minutely 2-cuspidate or truncate, smooth and polished below dorsally, keels granulate and scabrid, nerves about 4 between the keels.

Palamau, in moist ground in the forest! Fl. Oct.

Peduncles and peduncle of cluster smooth. Spatheole ·25–·3″, not at all acuminate, mostly with a row of small tubercles along the keel but not on the submarginal nerve, often strongly geniculate on the short peduncle and villous at the flexure, margins broadly hyaline or scarious. Involv. spkts. gl. i about 9-nerved altogether (7 n. between the keels of which 2 are imperfect), keels granulate, margin broadly inflexed; ii 3-n. also with broadly inflexed margins; st. 0 or 3. Sess. spkt. ·2″, callus bearded, gl. i narrowly lanceolar, keels scabrid except at top and bottom, about 4 imperfect nerves between keels, margins broadly inflexed over ii; ii polished, suddenly acuminate from one-third way up, 3 n. above, margins wrapping over iii; iii linear, hyaline, truncate, minutely denticulate; iv deeply 2-fid, ·05″ long including the finely subulate segments, awn very slender, sharply porrect near base, ·25″ long, smooth. Styles reaching tip of gl. ii and feathery stigmas exserted far beyond the awn. Grain ellipsoid brown ·05″ long.

81. APLUDA, *L.*

Annual or perennial, leafy and usually tall grasses. Leaves flat, upper reduced to spathiform sheaths. Inflorescence very compound, leafy. Spikelets in triplets (one usually very imperfect) subtended by a spathiform peduncled bract and articulate on a very short peduncle above the bract, usually 2–3 triplets and their bracts together with other imperfect spikelets fascicled on a branchlet which is again subtended by a common spathe, the arrangement being continued indefinitely according to the size of the panicle and the spathes gradually becoming more like ordinary foliage leaves downwards. Triplets (spikes) of one sessile 2-fld. 2-sexual spkt. with two pedicelled spikelets seated on a swollen common basal internode with a shelf-like support for the sessile spkt. Sessile spkt. Gl. 4, i charteaceous concave many-nerved, margins not or very narrowly inflexed; ii laterally compressed 5–7-nerved dorsally gibbous and keeled; iii ovate lanceolate hyaline, male, paleate; iv smaller, 2-sexual, ovate or oblong entire or 2-toothed or 2-fid, awned or not, palea small, lodicules 2, cuneate. St. 3, anthers short. Styles free. Grain oblong, embryo large. Pedicelled spkts. with their pedicels compressed equal and symmetrical to the plane of the sessile spkt., or one displaced laterally smaller and its spkt. reduced to a single glume in continuation of the plane of the pedicel, the other also somewhat reduced or usually flowering with 4 glumes more or less resembling the sessile spkt., but ii not gibbous and iv never awned, usually both fls. male.

1. **A. varia,** *Hack.* A. mutica, *L.*, inc. A. aristata, *Willd.* Syn. A. varia, *Hack.*; Tati, *K.*; Dhudhia-sauri, *S.*

A very variable grass with the characters of the genus. The two sub-species as here conceived look very different in the field, but *Hooker*, *Stapf* and *Hackel* all unite them into one species. There are many intermediates.

a. Sub-sp. **mutica** proper. Syn. A. geniculata, *Roxb.*, and also (?) part of *Roxburgh's aristata.*

A very slender grass creeping, climbing or suberect and geniculate with pale smooth delicate stems. Leaves narrowed above and below,

acuminate. Panicles strict with numerous very slender flexuous branches bearing distant narrow spathes, each with 3 or more fascicles of spikes, some of the spikes being reduced to their proper spathes with often scales at the bases of the peduncles. Spikes short about ·3″, proper bract or spathe to each triplet ·12–·25″, mucronate or shortly awned. Barren pedicelled spkt. lateral, often hirsute (var. *humulis*). Sessile spkt.; keel of gl. ii flattened above the gibbosity. Awn of gl. iv very weak or 0.

Chiefly in damp places and under shade. Purneah (common in the Tarai and Duars)! Behar, *Hope*! Santal Parg., *Kurz*! Ranchi (on the ghats), *Wood*! Singbhum! Manbhum, *Camp.*! Fl., Fr. Sept.–Nov. Annual or perennial?

B. Sub.-sp. **aristata,** *Hack.*

A tall perennial erect grass, often 6–8 ft. high, with a rather stout rootstock and very leafy stems and inflorescences. Cauline leaves distichous up to 18″ long, smaller upwards, ·3–1″ broad, setaceously acuminate, narrowed and sub-petiolate at the base, somewhat scabrid on the edges and sometimes with a few short hairs along the principal nerves. Panicle very leafy much branched with the fascicles close, spathes often with a long acumen or short blade. Spikes attaining ·52″ in length and curved, twice as long as their proper spathes. Both pedicels often equal and symmetrical, one with one glume, the other with 4 glumes and usually 2 male fls. Gl. ii of sessile spkt., pubescent upwards. Bulbous base of peduncle often ·1″ long.

This is var. *rostrata*, the extreme form of the subspecies. It is frequent on rocky hills in Gaya! and Chota Nagpur and Central Provinces!

Var. *aristata* proper is described as having a proper spathe rather shorter than its spike, sessile spkt. under ·2″ with a small bulbous base. Gl. i glabrous with scabrid nerves, barren spkt. minute and lateral.

It or intermediates are also common in the forests. Gya, *Mokim*! Monghyr! Singbhum! Parasnath! Fl., Fr. Oct.–Dec.

The grass is quite useless and cattle do not eat it.

82. MANISURIS, *Sw.*

Erect much branched annuals with cordate or subcordate-based leaves and axillary spikes sometimes forming a leafy panicle, rhachis fragile with short internodes deeply excavate, tips 2-pitted. Spikelets sessile and pedicelled very dissimilar, 1–2-fld. Sessile globose, 2-sexual, gl. 4, i hard orbicular, and only open towards the rhachis by an oblong aperture, enclosing the inner glumes, pitted outside in vertical rows or reticulate; ii chartaceous, filling the cavity in gl. i; iii hyaline empty; iv and its palea hyaline. Callus much swollen. Lodicules 2 broadly cuneate. Anthers minute. Styles free with short stigmas, exserted from the opening in gl. i. Pedicelled spkt. ovate or lanceolar, neuter with pedicel adnate to rhachis.

1. **M. granularis,** *L. f.*

A very distinct looking grass 6–8″ or up to 2 ft. high, very hairy with usually short leaves linear-lanceolate from a subcordate base or sometimes broadly linear and up to 8″ by ·5″, flat, flaccid, acuminate with hirsute inflated sheaths; ligule a raised ciliate margin. Spikes ·25–1″, each sheathed at the base, often several from one leaf axil. Sessile globose spkts. subsecund ·04″ diam. in two rows. Pedicelled

spkts. green distichous ·09–·1″ long, gl. i and ii subequal with winged keels.

Common in wet fields. Monghyr, *Mokim*! Santal Parg., very common! Hazaribagh (ascending to top of Parasnath), *Clarke*, etc.! Manbhum, *Anders.* etc.! Singbhum, on clay soils. Mayurbhanj, *Hooper*! Probably in all districts. Fl., Fr. Aug.–Dec.

83. OPHIURUS, *Gaertn.*

Tall or medium erect grasses usually branched upwards. Leaves linear to broadly linear, often convolute, ligules very short membranous. Spikes solitary or fascicled in the axils of leaves or spathes, their structure as in *Rottboellia* but the pedicelled spikelets completely suppressed or very rudimentary, the pedicels completely fused with the internodes. Gl. 4, i thickly coriaceous, convex, obtuse; ii almost membranous, keeled; iii elliptic, obtuse, hyaline, faintly 2-nerved, margins infolded, paleate, male; iv as long, oblong, obtuse, 2-nerved or nerveless, 2-sexual, palea narrow, lodicules 2 cuneate. St. 3. Grain oblong free.

A. Spikes very numerous from the axils:—
L. ensiform, very hairy. Robust 5–6 ft. . . . . 1. *megaphyllus.*
L. linear, glabrous. Slender 2–4 ft. . . . . 2. *corymbosus.*
B. Spikes subsolitary:—
L. linear, hairy. Very slender 1–2 ft. . . . . 3. *monostachyus.*

1. O. megaphyllus, *Stapf.* Syn. O. corymbosus, *F.B.I.* (in part).

A large stout grass 5–6 ft. high, very leafy to the top. Leaves narrowly ensiform, tapering from base to apex, upper ·4–·75″ wide, lower much wider, flat, very hairy as are the sheaths, but more or less glabrescent with age, hairs with small tubercle bases, margins of sheath hirsute. Spkts. ·12–·18″, slightly shorter or longer than the joints, in very numerous peduncled spikes 3–4″ long (perhaps longer but very fragile), from the leaf axils. Peduncles 3–5″ sheathed at the base, finally far exserted, each solitary on a branch with a villous node, often geniculate at the node. Gl. i oblong glabrous with rounded tip, smooth or with few lines of small pits.

In marshy places Tarai and Duars! probably in Purneah. Fl. Dec.

The spikes are ·05–·06″ diam. The lowest pedicelled spkts. are sometimes free at the top and bear a small brown free appendage. Gl. i of sessile spkt. does not become recurved, it also sometimes bears a small appendage; ii is white and becomes inclined forward quite free from the rhachis when the spkt. opens.

2. O. corymbosus, *Gaertn.* Syn. Rottboellia corymbosa, *L.*

Stems very numerous glabrous erect slender 2–4 ft. high bulbous at the base, the bulbous bases connected into a horizontal rhizome. Leaves linear glabrous up to ·2″ broad, margins minutely tubercled at base, the tubercles bearing cilia when young. Spikes very slender, 2–5″ long, only ·04″ diam. sometimes ending in a small tail like that of a rattle-snake, spikelets ·1″ equalling the joint. Gl. i glabrous with many longitudinal lines of small pits, narrowly-oblong, tip rounded, finally recurved.

Chiefly on cotton soil in the Central Provinces. Purneah, *Kurz*! It is, however, I believe, common but seldom collected. Fl. Aug.–Nov. Perennial.

Gaertner gives no description of the leaves (nor does *Linnæus*) and he shows the glumes too pointed, but there seems little doubt that this is the plant intended.

THE

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An Account of all the Known Indigenous Plants of the Province and of the Most Important or Most Commonly Cultivated Exotic Ones

By

H. H. HAINES, C.I.E., F.C.H., F.L.S.

Late Conservator of Forests, Bihar and Orissa

Published under the Authority of the Government of Bihar and Orissa

PART VI

Including Appendices and Index to Parts II–VI

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3. **O. monostachyus,** *Presl.*

Slender 1–2 ft. high, leafless upwards. Leaves linear, 1–4″ long by ·16″ or less, flat, hairy, margins smooth, ligule villous. Spikes very few solitary terminal and 1–2 axillary, very slender, 1·5–3″ long, ·05–·06″ diam. ending in a filiform tip marked with scars. Spikelets ·1–·12″ long, rather shorter than or as long as or slightly exceeding the joint, aperture with a thickened margin. Glume i oblong suddenly acute, smooth or with a few minute pits near base, a distinct transverse furrow between glume and callus.

Santal Parg., *Kurz, Mokim*! Hazaribagh, *Clarke*! Fl. Oct. Annual.
Much resembling at first sight *Mnesithea lævis*, under which all the *Calcutta Herbarium* specimens are included, but easily recognized from that plant by the hairy leaves and alternate (opening) spikelets.

84. ROTTBOELLIA, *L. f.*

Tall grasses, usually branched upwards, often with stilt roots from the lowest nodes. Leaves large, flat, broadly linear, ligules short membranous. Spikes few or many, cylindric and glabrous, subsolitary racemose or laxly panicled, with very fragile (articulate) rhachis, the internodes cupular at the tip and excavate on one side. Spikelets 2-nate, usually heteromorphous, sessile and pedicelled, almost flush with the spike (fitting into the excavate rhachis) before opening, sessile 2-fld., pedicelled often imperfect, male or neuter, the pedicel flattened more or less adnate to the internode, but superficially distinct, the spikelet overlapping the node next above. Uppermost pairs both similar and barren and finally forming a tapering appendage to the spike. Sessile spkt. with narrow callus adnate to the bases of the internode and pedicel into a glabrous ring with a knob in the centre which fits into the hollow of the next lower internode. Gls. 4, i coriaceous, flat or nearly so with very narrow inflexed margins, 2-keeled upwards, obtuse or subobtuse ; ii boat-shaped thinner, acute ; iii hyaline, male ; iv hyaline 2-sexual, 3-nerved ; palea as long 2-nerved ; lodicules 2, cuneate. St. 3. Grain broad-oblong or ellipsoid, dorsally compressed. Pedicelled spkt. with 2 male flowers or reduced.

1. **R. exaltata,** *L. f.*

A very large stout grass with polished stems ·3–·4″ diam. standing on stiff adventitious stilt-roots. Leaves up to 4·5 ft. long by 1·2″ broad, flat, hispidly hairy above or glabrescent leaving minute tubercle-bases, margins spinulose-scabrid. Spikes terete 3–4″ long, finally long-peduncled, each peduncle with its own proper very narrow spathiform leaf-sheath, diam. of spike ·05–·1″ before divergence of gl. i. Gl. i of sessile spkt. nearly flat, ·15–·22″ pale diverging in flower, oblong obtuse sometimes very narrowly winged towards the apex, nervation obscure, pitted between base and callus. Gl. i of pedicelled spikelet ·15–·2″ long, green, many-nerved, with white scabrid margins, acuminate with the acumen more or less 2-fid. Pedicel pale flat, shorter than spkts., distinct or free along its margins.

Grassy places in the forests or wet cultivated lands. Ranchi! Hazaribagh, Koderma forest (and Gyra, *Cal. Herb.*)! Singbhum, 2000 ft.! Monghyr, *Cal. Herb.*! Santal Parg.! Puri, "a pest in the paddy," *Walsh*!

85. MNESITHEA, *Kunth.*

Slender erect with very narrow leaves. Spikes as in *Hemarthria* but cylindric with the ends of the internodes hollowed out as in *Rottboellia*, the two spikelets sessile opposite, sunk in cavities which are only separated by a thin sometimes evanescent septum. The internodes are different on each face between the spkts., one side is broader than the other with 4 pale flat ridges spreading fan-wise above and three intermediate green grooves (not always clear in dry specimens); the other side is narrow with 2 lateral parallel narrow ridges or nerves and a broader green centre; this narrow side is the completely fused pedicel and sometimes bears a minute rounded or truncate glume (very rarely two glumes) representing the abortive pedicelled spikelet. The narrow and flat sides alternate in successive internodes.

The uppermost nodes sometimes bear only one sessile spkt. The genus then comes exceedingly close to *Ophiurus*, and it would be a more natural arrangement to combine the 4 genera *Rottboellia*, *Hemarthria*, *Ophiurus* and *Mnesithea* into one. *Sir J. D. Hooker* united three but still kept *Ophiurus* distinct.

1. **M. perforata,** *comb. nov.* Syn. Rottboellia perforata, *Roxb. Pl. Cor.*, ii (1798); Mnesithea lævis, *Kunth. Revis. Gram.*, i (1829).

Erect or somewhat decumbent at base, stems slender 2–4 ft. high, simple or branched above, nodes distant glabrous. Leaves linear very narrow 3–20″ (–30″, *J.D.H.*) by ·15″ flat or conduplicate strongly nerved, glabrous or with scabrous margins and midrib. Sheath villous at the mouth. Spikes 4–8″ long by ·07″ diam. (before the divergence of gl. i) or less; internodes slightly longer than or equalling spkt. Gl. i ·1–·15″ long, oblong rounded at tip or sometimes contracted at tip and obtuse, base sometimes with 3–4 pits, nerves obscure.

Common in wet ground, probably in all districts. Gya, *Mokim*! Monghyr, *Mokim*! Santal Parg.! Hazaribagh, *Anders.*, *Clarke*! Manbhum, *Camp.*! Singbhum, common! Orissa, *Walsh*! Fl., Fr. Aug.-Nov.

86. HEMARTHRIA, *R. Br.*

(Included in *Rottboellia* in *F.B.I.*)

Decumbent or ascending perennial grasses with branched many-noded culms and linear, conduplicate or flat leaves with very short membranous ligules. Spikes compressed, often curved, tips more or less subulate from the slender terminal spikelet, rhachis not or tardily breaking up. Spikelets 2-nate, nearly similar, pseudo-opposite and decussate owing to the fusion of joints and pedicels, each pair made up of a sessile spkt. and the pedicelled spkt. of the next lower node; internodes with the adnate pedicels semi-terete, tips truncate not hollowed out nor appendaged. Glumes 4; i flat dorsally, 2-keeled,

very narrowly inflexed along the margins, coriaceous, filling the excavated internode; ii membranous, adhering to the inner face of the cavity, subequal; iii hyaline 2-nerved; iv usually nerveless. Pedicelled spkt. with more elongate acuminate glumes, ii mucronate or aristate.

Weak, rarely erect. Spkts. ·1–·15″. Gl. ii of ped. spkt. acuminate, 7–9-nerved . . . . . 1. *compressa*.
Stout, erect. Spkts. ·17–·1″ Gl. ii of ped. spkt. awned 1–3-nerved . 2. *protensa*.

1. H. compressa, *R. Br.* Syn. Rottboellia compressa, *L. f.*

Cæspitose, dwarf and usually creeping below with many spreading branches, sometimes subscandent among bushes. Leaves linear acute, margins and sometimes upper surface scaberulous, mouth of sheath hairy. Spikes 1·5–5·5″ usually appearing fascicled in the leaf axils (one with a branch in a spathaceous bract or leaf, the branch bearing a spike and another branch and so on; before the elongation of the branches the whole forms a congested fascicle as in so many other grasses) or spathaceous sheaths; rachis coherent, ending in an acute tip. Sessile spkts. ·1–·15″ (–·2″, *F.B.I.*). Gl. i coriaceous obtuse or acute, 7–9-nerved; ped. spkt. i narrowly lanceolate, tip scabrid; ii acuminate or aristulate 7–9-nerved.

Wet places. Singbhum! Purneah (Kissenganj)! Santal Parg., *Kurz*! Fl. July–Oct.

2. H. protensa, *Steud.* Syn. Rottboellia protensa, *Hack.*

Erect from a decumbent base, 3–6 ft. high with linear leaves 3–12″ long by ·17–·25″ wide, narrowed each end, glabrous, margins smooth. Spikes often very long and numerous from the close leaf sheaths, 4–8″ long. Rhachis coherent (not breaking up), joints shorter than the sessile spkt. Spkts. ·17–·2″ long, awn or cusp ·04–·06″. Sessile spkt. gl. i many-nerved, narrowed from the middle upwards, subacute. Ped. spkt. gl. i 7-nerved; ii long-awned, 1–3-nerved.

Santal Parg., *Kurz*! Fl. March–May.
Both this and the preceding are, I believe, much more common than the collected specimens make appear.

87. POLYTOCA, *Br.*

Large erect grasses with bearded nodes and long flat leaves. Flowering branches fascicled sheathed by spathaceous bracts, proliferously panicled with often long naked internodes up to the next fascicle. Spikelets geminate, sessile and pedicelled on the articulate rhachis of solitary or panicled spikes, usually lower only on the spike, female or 2-sexual, upper spikelets male or sometimes upper spikes entirely male. Male spkts. lanceolate 2-fld. glumes 4, i many-nerved, 2-keeled; ii 5–7-nerved; iii and iv hyaline, paleate, 3-androus with very long anthers and cuneate lodicules. Fem. spikelets with the pedicelled imperfect, its pedicel confluent with the rhachis; sessile spkt. with the lowest glume (or bract?) oblong, coriaceous with the margins inflexed and embracing the rhachis, at length crustaceous or more coriaceous; ii thin acuminate; iii hyaline, epaleate; iv hyaline, paleate,

fertile; staminodes and lodicules 0. Ovary minute, styles long and stigmas long. Grain very small, orbicular enclosed in the hardened outer glume (or bract ?), which can always be distinguished from that of *Coix* by its being open or grooved on one side.

Inflorescence of simple spikes, male above, female below. Glume of fem. ped. spkt. very short or 0 . . . . . 1. *barbata.*
Inflorescence compound, sometimes entirely male. Glume of fem. ped. spkt. very long, up to ·9″ and bractiform . . . . . 2. *bracteata.*

1. P. barbata, *Stapf.* Syn. Chionachne barbata (*Fl. C.P.*); Coix barbata, *Roxb.*; Phultainr, *Or.*; Karpia, *Gond.* Sometimes also the names properly applicable to *Coix gigantea* are used.

A tall coarse grass 5–8 ft. high bearded at the nodes and more or less clothed with deciduous tubercle-based rather stiff hairs. Leaves lower cauline 2–3 ft. long over ·5″ wide, upper 12″ by about ·3–·5″ becoming smaller on the panicle. Flowering branches several from each upper leaf axil, 4–12″ long, bearing a foliaceous bract with several peduncles and one or more branches with long naked internodes which only bear a bract and peduncles or also continue the branching. Peduncles flattened above bearing a spathaceous obovate many-nerved truncate open bract ·5″ long with a more or less elongate cusp, in its axil is the short proper peduncle of the spike. Spike ·5–1·5″ long with a single basal female spikelet (and sometimes a pedicelled imperfect one), ultimately coriaceous or crustaceous, and 5–15 (2–7 pairs and an odd) male spikelets.

In savannah tracts and grassy forest. Common on cotton soil. Santal Parg., *Mokim*! Ranchi, ascending to the top of the pats (common at Neterhat, 3000 ft.)! Singbhum! Sambalpur, frequent! It becomes very common in the Central Provinces. Fl., Fr. Aug.–Oct.

Stems hollow or solid, straw-coloured or somewhat purple, often ·3″ diam. at base, sometimes grooved above the ascending branches. Sheaths and leaves both sides densely hairy but hairs falling off with age leaving the small tubercular bases. Ligule very short. End of peduncles villous. Spikes articulate on their short proper peduncles the end of which is cup-shaped. Coriaceous gl. i of fem. spkt. oblong ·22″ long, tip oblique entire or notched, involute margin tightly clasping rhachis of the spike. Male spkt. ·35″ long, gl. i oblong obtuse 9-nerved, margins inflexed keeled ciliate; ii lanceolate, white, margin inflexed, 7-nerved; iii lanceolate hyaline 3-nerved, staminate; iv similar but rather narrower, palea of both as long as glume.

It is said to be a bad fodder.

2. P. bracteata, *Br.* ?

A stout grass 3–5 ft. high with villous nodes. Leaves 18″–2 ft. long by ·7–1″ broad caudate-acuminate, somewhat narrowed towards the base, margins spinulose-serrulate. Inflorescence ultimately on slender peduncles, very fragile, mostly compound, some wholly male, others female below and male above, tightly enclosed in a convolute spathe with linear acuminate bracts at its base, which together with another rhachis, peduncle or axis is again enclosed in a spathe and so on indefinitely. Proper spathe of inflorescence 2·5–6″ long, with the margins above hirsute and bearing a filiform blade ·3–·75″ or more long. Female sessile spkts. oblong, ·35″ in flower to ·42″ in fruit, appearing 3-toothed from the 2 teeth of the glume i and the inter-

mediate tip of the closely appressed acumen of glume ii. Gl. i dorsally compressed with inflexed margins about half way up which become hardened, and inflexed membranous margins above, the keels also winged; ii broadly ovate with a very long narrow abrupt acumen, the tip of which reaches tip of i and fits in between its 2 flaps, both glumes many-nerved and becoming coriaceous in fruit, i more or less villous. Stigmas ·75″ long on capillary styles. Callus large rounded.

Frequent in the Duars and the Sikkim Tarai close to the Purneah border! and no doubt occurs within it. Fl., Fr. Oct.

This appears to agree with the specimens called *bracteata* in *Herb. Kew*, but if it is that species the description in the *F.B.I.* is very inadequate and in many respects it appears to combine the characters of *Cookii*, *Stapf*. The pedicelled female spikelets at the base of the inflorescence have long free pedicels about three-fourths length of sessile spkt., those at the top have very short or no free portion except the cup which projects from near the top of the joint. Ped. fem. spkt. ·9″ long, bract-like, with involute margin to the long and often only glume. The rhachis both of male in all stages and female after flowering exceedingly fragile with cupular ends to the joints. Male inflor. compound, gl. i bract-like, the margins sharply inflexed as far as gl. ii, lanc.-acuminate, sometimes with 2 teeth each side of acumen, ·45″ long; ii shining narrow oblong acuminate ·3″ with inflexed margins covering edges of inner glumes, 7-nerved; iii similar, 3-nerved with an accurately fitting flat palea and 3 st.; iv ·28″, narrower but similar. Ped. male spkt. ·5″ with pedicel adnate nearly to tip, gl. i conduplicate, the margin inflexed on one side; ii ·3″ sharply subalately keeled, 9-nerved; iii keeled, 3-nerved, ·3″, its palea with margins folding the 2–3 st.; iv ·28″, very hyaline with flat palea and 3 st.

88. COIX, *L.* Job's Tears.

Stout long- and broad-leaved grasses with numerous axillary and terminal spikes sometimes forming a large leafy panicle. Lower spikelet solitary female enclosed in a finally hard polished nut-like bract which sometimes also includes 2 rudimentary spkts. and through which the male portion of the spike projects. Male spikelets 2–3-nate at the nodes of the rhachis, one sessile and 1–2 pedicelled, lanceolate. Glumes 4; i and ii subequal empty; i keeled or winged along the inflexed margins; iii and iv hyaline, paleate, 3-androus or empty, lodicules 2. Fem. spkt. ovoid acuminate, glumes 4; i chartaceous; ii–iv successively thinner, iv paleate with minute staminodes. Lodicules 0. Ovary ovoid, styles 2, free, slender. Grain orbicular, ventrally furrowed, enclosed in the hardened globose ovoid or cylindric involucral bract. Whole spike ultimately deciduous from the truncate annulate tip of peduncle.

The following three species which are distinguished by *Roxburgh* may be merely varieties of one. *Prain* distinguishes *Lachryma-jobi* by its having only 2–3 male spikelets, but it often has many.

Stems 3–5 ft., leaves relatively broad. Spikes mostly short and spkts. mostly 2-nate . . . . . 1. *Lachryma-jobi.*
Stem very tall erect, leaves relatively narrow, spikes elongate often cernuous. Spkts. mostly 3-nate . . . . . 2. *gigantea.*
Stems very long, floating and creeping, spikes elongate drooping 3. *aquatica.*

1. C. Lachryma-jobi, *L.* Horeng, *M.* (also Danghir in Ranchi); Jargadi, *S.*; Kasai, *Gond.*; Sankru, *H.*; Gurgar, Kunch, *Beng.*

A very stout grass with stems often ·5″ diam. near base and with large broad leaves 4–18″ long by 1–2″ broad, linear-lanceolate from a

broad often cordate base, margins cartilaginous scabrid and cutting. Peduncles 1–2·5″ long, flattened or 3-gonous, usually a large number from the axil of one leaf together with oblong bracts. Male inflorescence ·5–1·5″ long, glabrous (mealy, *Roxb.*), erect or nodding. Spikelets sessile and one pedicelled. Gl. i ·3–·35″ long, lanceolate or with the narrow or broad wing becoming obovate. Pseudocarp mostly broadly ovoid ·3″ long, white or bluish polished.

Common along water courses, ditches, etc. In all districts of Chota Nagpur! Santal Parg.! Puri, *Walsh*! Probably throughout the province. Fl., Fr. Sept.–Feb.

Horses are fond of the leaves but soon tire of it. A poor fodder for cattle.

2. **C. gigantea,** *Kön.* Same vernacular names, also Danga gurgur, *Beng.* (*fide Roxb.*).

A tall erect grass up to 15 ft. high by ·7″ diam. at base, terete and polished. Leaves, lower 2–4 ft. long by about 1″ broad, base obtuse or subcordate, margins scabrid and cutting, upper leaves erect narrow-lanceolate 8″ by ·7–·8″ or longer and narrower, sometimes scabrid above. Peduncles 2–6″. Male spikes often very short when young but elongating with ternate spikelets, the large outer glumes of which form 6 imbricate rows on the spike which is ultimately drooping and with a long internode between the female and the lowest male spikelet.

Frequent on rocky northern slopes in Chota Nagpur and Orissa! Also Purneah, *Cal. Herb.*

It is doubtful whether any of the characters of the inflorescence given here are peculiar to this species or even universal in it, as very few specimens have been examined and fewer still preserved.

Sessile spkt. gl. i elliptic or obovate with the broad wing of pedicelled spkt. somewhat cymbiform but with rounded keel, many-nerved, ·5″ long; ii smaller lanceolate, pale; iii included in i, pale hyaline with a raised plicate longitudinal ridge inside bearing 2 large pulvinate lodicules between which arise the 3 stamens, palea as large; iv smaller hyaline with 2 large erect quadrate lodicules and large palea, bearing a rudimentary ovary. Bract of fem. with a distinct ligule, often conical in fruit, including also 2 rudimentary pedicelled spkts.

3. **C. aquatica,** *Roxb.*

The following account is taken from *Roxburgh* (in slightly different words):—Stems perennial jointed, round, smooth, filled with pith, about as thick as a man's forefinger, floating on lakes or creeping along their margins for 50–100 ft., shoots arising in an oblique direction to 4–5 ft. above the surface. Leaves, lower linear lanceolate, upper linear or ensiform 1–3 ft. long 1–1·5″ wide long-acuminate, margins hispid. Spikes terminal and from the exterior axils, peduncled, solitary or in pairs, drooping, many-fld., 3-nate, two sessile and one central pedicelled. Female generally solitary at the base. Involucre turbinate, perforated, valves (glumes) 6–7 with two abortive corollets and their common valve, as in *gigantea* (this perhaps refers to the rudimentary spikelets noted by me in that species). Ovary oblong with 3 short abortive staminodes.

There are two specimens labelled *aquatica* from our area. The first from Monghyr resembles *gigantea* in the herbarium and possibly is *gigantea*. The second from Balasore, a more likely locality, is a very interesting specimen as the

involucral bract has a well-developed lamina 2-5″ long. The leaves in both are linear and there are no remarks on habit.

89. EUCHLÆNA, *Schrad.*

Stout and tall annuals with very broadly linear or oblong leaves. Male spikelets 2-nate (sessile and pedicelled) on the spiciform fascicled branches of a terminal panicle, 2-fld. with coriaceous glumes. Female spikelets in 2-ranked spikes which are clustered in the leaf axils, not fused as in the Maize, joints trapezoidal oblique articulate excavate with the margins of the excavation embracing the cartilaginous outer glume and with it forming a smooth pseudocarp.

1. E. mexicana, *Schrad.*, var. **luxurians.** Syn. Reana luxurians, *Brogn.*

A large very succulent grass 3–6 ft. high. Leaves long 2–3″ wide. Male spkts. ·3–·35″ long crowded in long spikes in a corymb 6–10″ long. Fem. spikes in the leaf axils.

Native of Central America. Often grown for fodder (by Europeans), but it does not stand drought well. Horses are very fond of it.

90. ZEA, *L.* Maize.

Tall stout annual with large leaves, the axils of the lower bearing the female inflorescences. Male inflorescence terminal on the same plant, of panicled spiciform racemes with 2-nate spikelets shortly unequally pedicelled or one sessile on the inarticulate rhachis, both similar, 2-fld., with subequal ext. glumes 9–10-nerved, floral gl. more or less hyaline 3–5-nerved, palea similar 2-nerved, lodicules fleshy, stamens 3. Female spikelets sessile densely crowded in vertical series on the thick central axis of a cylindro-conical sheathed inflorescence, which is probably the coalescent axis of several spikes, 2-nate, each with a lower barren and an upper fertile floret; ext.-glumes very broad, fleshy below, hyaline above, nerveless, ciliate; floral glumes 2 shorter and eciliate. Ovary obliquely ovoid, style very long, 2-fid at the tip, exserted in long silky tassels from the large bracts which sheathe the inflorescence. Fruit large, becoming exserted from the small glumes.

One species only, native of America.

1. Z. Mays, *L.* Bhutta, Makai, *Vern.*; Jondra, *M.*; Maize; Indian Corn.

Cultivated in all districts, but chiefly in Chota Nagpur, Gya and north of the Ganges (Bhagalpur, Darbhanga, etc.). Frequently the first crop sown on jhumed lands. Usually reaped at the end of the r.s. (Sept.-Oct.).

Yellow, red and white grained varieties are grown in Chota Nagpur; the usual colour being a deep yellow. Special varieties are grown in gardens for cooking and eating in the unripe state.

Satwa, which is so often given in water as a drink for horses, is frequently made of ground Maize (at other times of ground parched gram and barley), but it is considered inferior.

SERIES.—ENANTIOBLASTÆ.

FAM. 140. ERIOCAULACEÆ.

Marsh or aquatic herbs with narrow or grass-like radical or (in aquatics) cauline leaves and very minute flowers bracteate in involucrate capitate scapose heads, unisexual but usually monœcious. Perianth in 2 whorls inferior. Male fl.: outer perianth whorl or sepals of 2–3 free or connate scales, petals 2–3, equal or unequal, often very obscure, inserted on the top of a clavate elongate stipes or corolla-tube, stamens 6 or fewer, some often reduced to filaments, anthers dosifixed, pistillode minute or 0. Fem. fl.: sepals 2–3 caducous, petals 3, rarely 2 or 0, persistent, spathulate or oblanceolate, usually ciliate or villous, and with 1 rarely 2 black glands. Ovary 3, rarely 2-celled, style short persistent, stigmas 2–3 slender, with sometimes interposed lobes or appendages, ovules solitary in the cells, pendulous, orthotropous. Fruit a loculicidal 3-lobed membranous capsule, lobes globose. Seeds pendulous, testa coriaceous, striolate and often papillose, embryo outside the floury albumen.

The Indian species all belong to the genus *Eriocaulon*. The family is sometimes called the Compositæ of the Monocotyledons. They present great difficulty in the variability of the bracts and flowers in a single head. I have consulted *Ruhland's* monograph and *Fyson's* paper on the Indian species.

1. ERIOCAULON, *L.*

Inner scales of the involucre not forming a ray. Fls. 2–3-merous, inner perianth lobes (petals) free, often with glands on the inner side, sometimes also in the male. Stamens 6 or 4 or fewer by abortion, anthers 2-locellate.

I. Water plants, only the peduncles rising above the surface, stems elongate, submerged :—
  Anthers black. Peduncles numerous sub-corymbose, short . . . . . 1. *setaceum.*
  Anthers white. Peduncles solitary, very long. . . . 2. *rivulare.*
II. Terrestrial on wet ground, leaves all radical forming a tuft or rosette. Peduncles scapose :—
  A. Anthers white :—
    Very small. Male calyx spathaceous. Bracts glabrous 3. *Sieboldianum.*
  B. Anthers black :—
    1. Involucral bracts not longer than the floral, reflexed or spreading :—
      a. Floral bracts with dark tips closely covered with short stout hairs. Recept. or base of fls. villous :—
        i. Small plants 3–8″ high. Sepals flat. M. petals small, one usually larger than the other two :—
          L. not red. Hds. dark, ·1–·2″ diam. Fl. bracts obtuse or suddenly acute . . . 4. *trilobum.*
          L. usually red at base. Hds. white (from the dense hairs) ·2–·25″ diam. Fl. bracts acuminate . . . . . 5. *quinquangulare.*
        ii. Taller, attaining 12–15″. One M. petal often twice as long as the other two. Two sepals cymbiform :—
          Hds. white ·25–·3″ diam. Invol. bracts 2-seriate . . . . . 6. *collinum.*

b. Floral bracts glabrous or nearly so. Recept. glabrous or villous. M. petals all minute or 0:—
Height 7–16″. Recept. villose. Fl. bracts subaristate . . . . . 7. *oryzetorum.*
Height 3–7″. Recept. glabrous. Hds. broader than long. Fl. bracts obtuse or acute. Fem. sep. 3–2 . . . . . 8. *truncatum.*

2. Bracts all pale or inner dark grey. Invol. campanulate, bracts never reflexed, erect or finally spreading, exceeding the floral:—
a. Floral bracts short rounded or truncate and hirsute at the tips. . . . . 9. *xeranthemum.*
b. Floral bracts glabrous or slightly hairy at the more or less pointed tips:—
Invol. bracts rounded, not longer than the rest of the head . . . . . 10. *achiton.*
Invol. bracts acute, exceeding rest of the head . 11. *Edwardii.*

1. E. setaceum, *L.* Inc. E. capillus-naiadis, *Hook. f.*

A submerged aquatic with the stems clothed with short capillary leaves 1·5–2″ long, densely disposed like the hairs of a tail; the tip of the stem floats at or near the surface and bears very many slender umbellately fascicled 6-ribbed peduncles 1·5–3″ long which are exserted from the water. Heads small, only about ·1″ diam., pale grey or nearly black.

Floating in stagnant waters, Northern Bengal (Titalyah), *Kurz*! Probably also Purneah. Fl. Aug.–Sept.

Leaves very slender flexuous 1-nerved. Sheath of peduncles ·75–1″ long with membranous tip. Receptacle convex or conical, villous. Invol. bracts very small, oblong or cuneate, glabrous. Fl. bracts cymbiform all or outer glabrous, said to be coriaceous and black in form *setaceum*, membranous and whitish in form *capillus-naiadis* (but I think *Ruhland* rightly unites the two in one species), inner with long white dorsal hairs in form *capillus-naiadis* (always ?). Male sepals usually connate into a split spathe, corolla-tube with 3 very minute petals with white hairs, stamens 6 with black anthers. Fem. sepals obovate-cymbiform, hairy on the back at apex, petals 3 narrow ciliate, usually with a black gland. Seeds oblong smooth dark brown.

Our plant is named *E. capillus-naiadis* in the *Cal. Herb.*

2. E. rivulare, *Dalz.* Var. ?.

A submerged aquatic with long stems clothed with slender flaccid leaves 6–9″ long dilated membranous and conspicuously fenestrate at the base. Peduncles few, very long, 12–20″, 10-sulcate, the grooves corresponding to inner tubes round a central core. Heads ·3″ diam., white-villous on a pale or black ground. Invol. bracts pale grey or black glabrous suborbicular or transversely oblong, partly reflexed in fruit, concealed by the broader head.

Deep running streams in the forests, Saranda, Singbhum! Fl. Feb.–April (probably also at other times).

Stems often emitting roots in the water. L. ·07″ wide above the dilated sheath, with 4–7 nerves and fine cross-nervules, tips filamentous opaque. Sheath of peduncles 3″ long, inflated, oblique and split at mouth. Head broader than long, Invol. br. about ·05″ long, often twice as broad, somewhat irregularly truncate. Fl. br. ·08–·09″ linear-oblanceolate or cuneate-oblanceolate and suddenly acute, usually black towards tip where it is clothed dorsally with white short stiff hairs. Receptacle convex glabrous (or pilose, *Ruhland*), clothed at tip with persistent bracts. M.: calyx spathaceous obcuneate or splitting into sepals, shortly white-hairy at tip, pet. minute, one longer and exceeding calyx, villous, st. 6, anthers white. Fem. sepals 2 (or 3 ?), linear-oblong narrowed below, ·08″ long, black with few hairs at apex and on back, concave; stipes and pedicel about ·02″ or

less, petals narrow-clavate, one rather larger, nearly as long as sepals, densely fimbriate-woolly and with a small black gland, sometimes with 2 glands. Capsule broader than long, ·2″ diam., seeds amber-coloured, broadly ellipsoid with a broad hilum and smaller micropylar scar the other end.

Prof. P. F. Fyson has kindly examined my specimens of this plant but has been unable to decide to which of the species of this group (*rivulare, breviscapon, fluviatile, miserum*) it should be assigned or whether it is a fifth species. I have thought it best therefore to name it as above, *rivulare* being the first described. They may be varieties of the same species grown under different conditions.

3. **E. Sieboldianum,** *Sieb. & Zucc.*

A very small annual 2–4″ high with numerous radical subulate or setaceous leaves ·6–2″ long and slender peduncles. Heads small globose or ovoid ·07–·2″ long, pale or sometimes purplish, with glabrous scarious bracts. Invol. bracts obovate or oblong, truncate toothed or lacerate, much shorter than the head and concealed by it. Floral bracts lanceolate or linear-oblanceolate and subacute, shining, M. calyx spathaceous broadly spathulate toothed, anthers white.

Common in old rice-fields. North Bengal (and probably Purneah), *Kurz* ! Singbhum ! Hazaribagh, *C. B. Clarke* ! Fl., Fr. Oct.–Nov. Probably in all districts.

Fl. bracts about ·08″ long. Recept. columnar, glabrous or sparsely villous. Fem. sepals 1–2 very slender or 0, corolla 0, stipes long. Style arms about as long as shank. M. petals most minute or 0, st. 1–6. Seeds brown broadly ellipsoid or ovoid ·01″ scarcely marked (even under 20 diam.), hilum broad, tip mucronulate.

4. **E. trilobum,** *Ham.* Syn. E. Solleyanum, *Royle* (Ill. t. 97).

A small plant 3–8″ high with the ensiform leaves mostly erect, ·7–2·5″ long, many-nerved. Heads small, rarely over ·15″ diam., globose, dark-coloured. Invol. bracts oblong nearly glabrous, obtuse, usually exceeding the radius of the head, spreading or reflexed. Floral bracts obcuneate with triangular obtuse tip or suddenly acute (but not acuminate as in *E. quinquangulare*), triangular tip with short white hairs at the back. Sepals : fem. oblanceolate concave and more or less keeled at the tip, with a few white hairs, in male more or less connate with rounded tips. Petals : fem. linear slightly broader upwards, with few white hairs. Male : not longer than the stamens and almost concealed by the hairs, usually with a black gland. Seeds amber-coloured ·017″ long, with close minute lines (only seen when magnified about 20 diam.).

Behar, *J.D.H.* ! Hazaribagh, *Anders., Clarke* ! It is also found in the Sikkim Tarai, and as it extends from the Upper Gangetic Plain to Eastern and Lower Bengal, it will probably be found in most of our districts. Fl., Fr. Oct.–April.

L. fenestrate, not red as usually in *quinquangulare*, which it much resembles. Receptacle globose, villous.

5. **E. quinquangulare,** *L.*

Usually dwarf 5–7″ high with a crowded rosette of linear ensiform leaves 1–3″ long, usually tapering from base to apex without distinct sheath, 8–12 nerved, obscurely fenestrate between nerves. Peduncles few or densely crowded 5–8-ridged upwards. Heads globose or somewhat ovoid ·2″, rarely ·25″ diam., intruded at base. Receptacle globose or columnar, covered with fine villi (sometimes adhering to the base of the flower). Involucral bracts pale concave

reflexed, oblong-oblanceolate or broadly obcuneate. Floral bracts hyaline, ·6–·08″ long, broadly obcuneate, shortly pubescent in upper half, suddenly cuspidate, cusp triangular sometimes almost aristulate at tip ciliolate.

The commonest of our species, specimens collected or seen by me from nearly all districts! and no doubt occurring throughout the province. In swamps and paddy fields. Fl., Fr. Nov., Oct.–Feb.

Leaves opaque or sub-translucent, often bright red when dry. Some of my specimens have over 100 heads. Peduncle without conspicuous tubes within; sheath short acute with membranous tip. M. fl. subsessile, sep. linear-oblanceolate, shortly hairy at the obtuse tip, only about half as long as bract; cor. long-stipitate, one petal much larger than others, but scarcely protruded beyond the bract, stamens 6. Fem. fl. shortly pedicelled or subsessile, sep. narrowly linear-clavate, hairy in upper half, pet. nearly as long on slender stipes and with filiform base, sparsely hairy, and each with a black gland, style very short, stigmas slender. Capsule ·2″ diam. Seeds yellow, only ·01″ long, broadly ellipsoid, appearing transversely lineate under high magnification (20 diam.), and sometimes with longitudinal lines or microscopically hispidulous (usually described as smooth and not ridged), hilum prominent.

6. **E. collinum,** *Hook. f.*

Rather robust attaining 12–15″, with subulate leaves 1·5–2·5″ long. Peduncles often flexuous. Heads ·25–·3″ diam. white. Involucral bracts, outermost narrow-oblong reflexed, next orbicular-oblong rounded dark-grey, glistening, spreading, concealed by the head, glabrous or nearly so, minutely irregularly toothed or entire. Floral bracts narrowly obcuneate with acute triangular tip, ·08–·1″ long, tip incurved and densely covered with short white stout hairs, base villous. Male fl.: ·1″ long with the pedicel, villous at base. Sepals connate about half the length of the flower or more but easily separable and sometimes 3 distinct, obcuneate, rounded, dark-grey, ciliolate with papillose hairs, ·05″ long, corolla-tube stipitate funnel-shaped, petals 3 white, one nearly twice as long as the others, the other 2 often reduced to a slender very hairy axis (but in some fls. subequal), all petals with a black gland. Fem. fl.: Sep. linear, 2 somewhat cymbiform, ·08–·09″ long, grey with few white hairs. Petals as long, more narrowly linear with very narrow base, hairy in upper half. Seeds ·02″ long, ellipsoid, amber-yellow, minutely transversely white-striate and with few (about 6) whitish longitudinal striæ.

Neterhat, elev. 3000 ft. near streams! Fl., Fr. May.

I have described our plant only without generalizing from other specimens as this is a marked extension of the hitherto known distribution. I have, however, collected similar plants on the Central Provinces plateaux.

L. gradually tapering from base to apex, often conspicuously fenestrate on the back with 7–9 rows of cells. Peduncles about 7-angled. Involucral bracts 2–3-seriate the outermost much narrower than the 1–2-seriate inner. Receptacle and base of flowers with long delicate villi. The transverse striations on the seeds are easily seen with a mag. of 10 diam.

7. **E. oryzetorum,** *Mart.*

Usually stout 7–16″ high with leaves 1·5–3″ long by about ·2″ at base, spongy, many-nerved, tapering from base to apex or linear obtuse, usually very fenestrate at the base when dry. Heads globose elongating to oblong-ovoid, not at all white, but pale brown when dry, said to be yellow when fresh, externally glabrous and somewhat

shining. Recept. conical or columnar, villous. Bracts all membranous or scarious, involucral glabrous obtuse, floral glabrous or nearly so (minutely scabrid), densely imbricate, cuneate-obovate sharply cuspidate or sub-aristate. Male sepals 2, fimbriate or glabrous at tip, pet. minute or 0, st. 6. Fem. sep. 3, slender, caducous; petals filiform to oblanceolate, glabrous or ciliolate. Seeds yellow, transversely lineolate.

Sirguja, *Clarke*! Probably also in the Northern Area. Fl., Fr. Oct.–Nov.
An easily recognized species from the glabrous heads with sub-aristate floral bracts.

8. **E. truncatum,** *Ham.*

Small 2·5–7″ high with leaves ·7–2·5″ long tapering from base to apex, closely striate. Peduncles many, rather stout. Heads small ·15–·2″ diam. or attaining ·3″ diam. very depressed and always much broader than long with glabrous membranous shining broadly lanceolate or cuneate involucral bracts reaching to the top. Receptacle glabrous, narrow. Fl. bracts obovoid scarious almost truncate to acute, incurved and imbricate, glabrous. M. fl. with free or connate sepals and minute ciliate petals. Fem. fl. sepals 3 or 2, linear to linear-lanceolate or narrowly oblanceolate, flat or boat-shaped, petals 3 linear or filiform, ciliate. Seeds pale-yellow, ribbed, ribs papillose.

Monghyr, *Ham.*! This is the type (*Wall.* No. 6076). Fl. June.
I have been unable to examine the type except superficially, but I see that I noted the involucral bracts as obtuse and the floral bracts as acute, whereas the *F.B.I.* says "floral bracts obovoid, tip concave truncately rounded." The species is easily recognized by the very depressed heads and glabrous or nearly glabrous receptacle and bracts.

9. **E. xeranthemum,** *Mart.* Syn. E. xeranthemoides, *Heurck.*

A minute herb ·7–3″ high with comparatively broad leaves ·3–1·3″ long, ·05–·2″ in breadth, many-nerved, subulate-acuminate. Sheaths of peduncle inflated. Peduncle stout striate. Heads very characteristic from the involucre of about 6 suberect, ultimately stellately spreading, lanceolate acute scarious pale shining outer bracts ·15–·2″ long, far exceeding the rest of the head. Floral bracts less than half length of involucre subquadrate, obovate rounded or truncate with hirsute tips. Receptacle globose, glabrous or hairy (*xeranthemoides*). Fls. subsessile, M. sepals 3 free or somewhat connate, petals minute or 0. Fem. sepals narrowly oblanceolate 3 equal or third capillary or 0. Seeds linear-oblong, pale yellow, papillose all over.

Chota Nagpur, *F.B.I.* and *Beng. Pl.*, but the only specimens seen from our area are those now referred to *Edwardii* or *achiton*.
The type is *Wallich's* 6081 from Nepal and Silhet. The outer invol. bracts are ·15″ long subacuminate, outermost floral similar but much shorter and other floral quite different. The drawings show 2 female sepals, 3 oblanceolate hairy black-glandular petals, clavate male flower with 3 hairy-tipped rounded oblanceolate sepals.

10. **E. achiton,** *Koern.*

A very small species 1–4″ high with subulate or ensiform leaves ·2–·7″ long, delicately 3–5-nerved and with cross-nervules (fenestrate), base dilated scarcely differentiated into a sheath, sparsely woolly.

Peduncles mostly showing a spiral twist, their sheaths ·3–·6″ also often twisted, membranous above. Heads button-shaped to ovoid, ·1–·18″ diam. pale. Involucral bracts longer than the floral, ovate-lanceolate to narrowly lanceolate acute or obtuse. Floral bracts cuneate obovate or oblanceolate, sometimes slightly hairy at back towards the minutely cuspidate tip. Receptacle distinctly villous, columnar. Male calyx with 2 distinct sepals, sepals linear tapering to the base, tipped with few hairs, corolla stipitate very minute imperfect with usually one distinct linear petal shorter than the stamens, pedicelled. Fem. fl. pedicelled; sepals very slender or 0. Petals 3–0, linear acute with few erect hairs, ovary usually slenderly stipitate. Seeds broadly ellipsoid, with minute transverse areoles.

Singbhum! Fl., Fr. Nov.–Dec.

This is not typical *achiton*, which has very small rounded heads ·1–·15″ diam., with very rounded silvery membranous involucral bracts not longer than the head, inner dark grey, female sepals 2–3 oblanceolate hairy, petals 3 linear narrowly linear hairy or of 3–0 hairs.

11. **E. Edwardii,** *Fyson* (Journal of Indian Botany, vols. ii and iii).

The following is *Fyson's* description (transcribed): L. 2–5 cm. long, 4–6 mm. broad at the base, acute, glabrous, slender. Peduncle 6–20 cm. slender. Heads 3–5 mm. obconic but finally globose, involucre bracts not reflexed, 4 mm. long, scarious, glabrous, elliptic, acute, a little longer than the floral bracts. These glabrous, obovate acute, grey (pallido-nigræ). Receptacle tall villous. Fem. fl. Sep. 2, slender, petals 2 linear or 0. M. fl. sepals 2 ? connate into a spathe, petals 0, anthers 6, black. Heads globose or nearly so, in bud overtopped by the acute involucral bracts.

Ranchi (*Clarke's* No. 34327)!

From an examination of the same material I find that the base of the leaves is somewhat hairy, the floral bracts sometimes minutely hairy. M. sepals sometimes 2 quite distinct and lanceolate or linear-oblanceolate. Fem. petals often filiform, sometimes 2 capillary and a third linear, so that I conclude the Singbhum plant referred by me to *achiton* is almost intermediate between that species and this. The involucral bracts are too short and obtuse to be true *Edwardii*, which species however I would personally consider merely a form of *achiton*.

Var. **Clarkei.**

To this species I refer provisionally *Clarke's* No. 24788 collected at Giridih (Hazaribagh), which was left unnamed by *Hooker* for the *F.B.I.* as being too young. It appears to be a variety with very acutely cuspidate bracts, involucre bracts erect ·12″ as long as whole head, about 6, oblong, pale, finely acuminate. Fl. bracts ·1″ fuscous, almost awned. Fem. sep. 2, narrowly linear. Petals 0 but stipes sometimes apparently villous above the sepals! Male sepals spathaceous, sometimes 3-toothed (but *Fyson* described his *type* as spathaceous with a "?," and I think it is either a matter of age, or position in the head, as I found obviously 2 free sepals in the type), staminal column clavate with about 3–5-stamens and a black gland, petals 0 or 1 minute linear.

In the villous stipes it appears allied to the Brazilian *E. griseum*.

FAM. 141. XYRIDACEÆ.

Tufted herbs with radical linear or subulate leaves and axillary and terminal simple naked scapes sheathed at the base, and with a terminal 2-sexual head or spike of small sessile flowers in the axils of rigid dark-coloured imbricating bracts. Flowers heterochlamydeous. Calyx bilateral, with an anterior dorsal larger caducous sepal embracing the corolla and 2 lateral oblique smaller ones, scarious, persistent or deciduous.* Petals 3, clawed, yellow, marcescent, claws connate into a slender short or long tube below. Stamens 3 fertile, and 3 outer obsolete or converted into staminodes, anthers sagittate, filaments adnate below to corolla tube. Staminodes usually of 2 long hairy filaments. Ovary superior 1-celled or incompletely 3-celled, with 3 parietal or basal and confluent placentas, style 3-fid, stigmas capitate or dilated. Ovules numerous anatropous. Fruit a loculicidal 3-valved capsule or top circumsciss. Seeds many, linear or ellipsoid, with floury albumen and minute embryo at the top of the seed.

1. XYRIS, *L.*

The only Indian genus.

Stout 1–2 ft. high. L. ·12–·3″ broad. Hds. mostly ·4–·5″ diam.
Fls. ·5″ diam. Throat of corolla not bearded . . . . 1. *indica.*
Slender 2 ft. high. L. ·1″ broad. Hds. mostly ·25–·3″ diam.
Fls. ·4–·5″ diam. Throat of corolla bearded . . . . 2. *coronata.*
Slender 8–12″ high. L. under ·1″ broad. Hds. ·25–·3″ diam.
Fls. about ·3″ diam. Throat of corolla not bearded . . . 3. *pauciflora.*

1. X. indica, *L.*

Very robust as compared with the two following species, 1–2 ft. high with leaves ·12–·3″ broad and brown heads mostly ·3–·6″ diam. and up to ·7″ long, on prominently ribbed and grooved peduncles. Bracts orbicular or cuneately obovate, ·25″ broad, usually broader than long. Flowers bright yellow, ·5″ diam. with orbicular erose petals.

Dinajpur and Maldah and probably, therefore, Purneah. Puri (Khurda and Mendasal), *Lace* ! Fl. Oct.–Nov.

Leaves spongy, obtuse, sometimes as long as scape. Head ovoid or globose with closely imbricate dark red-brown shining bracts with scarious margins. Lateral sepals narrowly boat-shaped, with dorsal serrulate wing. Claw of petals as long as sepals. Filaments short broad, staminodes shown by *Clarke* as slightly laciniate scales but in a drawing in *Herb. Rottl.* as feathery hairy tufts. The character of the staminodes requires further examination in fresh specimens, as also in the following species.

Said to be a cure for ringworm in Bengal (*Watt*), but it is not mentioned by either *Dutt or Nadkarni.*

2. X. coronata, *n. sp.* ? (see remarks under X. pauciflora).

Slender 2–2·5 ft. high. Leaves 0 or one sheathing the scape and much shorter than it, blade flat with acuminate tip, ·1″ broad at its base. Scape obtusely angled and with a single ridge, very minutely scaberulous. Spike subglobose, usually broader than long, ·25–·3″ diam. Outer bracts empty ovate, nerved, obtuse or subcuspidate, uniform (not winged). Flowering ·25″ long, broadly cymbiform, keeled near the top and some cuspidate, 3 lateral nerves at some

* *Prain* says all caducous, but they are persistent in all our species till the fruit ripens.

distance each side of mid-rib. Median sepal very caducous (0, ?), lateral cymbiform, keeled, ·25″ long, nerveless, persistent. Corolla ·45″ long including the ·25″ long tube, petals yellow, obovate, ·2″ diam. nerved, shallowly irregularly toothed. Stamens half as long as petals, stout, throat of corolla between the stamens and in addition to the feathery staminodes densely bearded with closely septate hairs as long as the stamens, some of them slightly clavate. Style and its branches stout, stigmas lobed. Capsule broadly elliptic, ·2″ by ·15″. Seeds ellipsoid or oblong, longitudinally ridged, ·02″ long.

Ranchi pats, amongst grass, 3000 ft. elev.! Fl., Fr. Oct.

3. **X. pauciflora,** *Willd.*

A small marsh plant 8–12″ high with erect rigid grass-like leaves 3–8″ by ·06–·08″ and slender striate subterete or compressed and 2-edged smooth or scaberulous scapes with a globose or ovoid head ·25–·3″ long. Bracts orbicular or obovate, rounded and emarginate, very concave, uppermost sometimes cuspidate, with central lanceolate brown centre and lighter coloured thinner wings or margins, all scarious, brown, shining. Flowers about 6 altogether, median sepal very caducous, lateral persistent scarious conduplicate or cymbiform, ·18″ long oblanceolate. Corolla about ·3″ diam.

Frequent in marshes. Plateaux of Chota Nagpur! Gya, *T. Thomson*! Puri, *Clarke*! No doubt also in the northern districts, as though no specimens have been collected it has been collected each side. Fl., Fr. c.s.

Root a small fibrous tuft. L. usually 3–4 shorter than the scapes, smooth or scaberulous, very rarely ·1″ broad. Scapes 1 or more, sheathed at the base by a leaf.

I have not dissected the fresh fls., and from herbarium specimens find it impossible to describe either corolla or staminodes, but they appear to be quite different from those in the last described specimens, which are doubtfully a variety or a separate species.

FAM. 142. FLAGELLARIACEÆ.

Stems leafy, erect or scandent by the cirrhose leaf-tips. Leaves many-nerved or plaited, with petiole 0 or sheathing. Flowers small in terminal panicles, homoichlamydeous, 1–2-sexual, regular, except for the somewhat unequal tepals. Tepals 6, 2-seriate, persistent, imbricate, free, inferior, dry or sub-petioled. Stamens 6, hypogynous with erect basifixed anthers. Ovary 3-celled with styles 3 or one 3-cleft. Ovules 1 in each cell, anatropous. Fruit fleshy or drupaceous or with 1–3 pyrenes. Seeds laterally attached with copious floury albumen. Embryo lenticular, with the radicle lying on the outside close to the hilum.

1. FLAGELLARIA, *L.*

Stem climbing by the cirrhose leaf-tips. Flowers 2-sexual. Perianth subpetaloid. Style arms 3, entire or 2-partite. Fruit drupaceous with a thin succulent exocarp and bony 1–2-seeded endocarp.

1. **F. indica,** *L.* Ban-chanda, *Beng.*; Harcharal, *H.*; Bomugra, *Or.*

A tall plant with reed-like stems, sometimes climbing. Leaves sessile on their truncate ·7–1″-long tubular sheaths, lanceolate, 3–9″ long with finely acuminate cirrhose tips, many-nerved. Flowers

sessile clustered very small, sub-scarious white, clusters in irregularly branched panicles 3–12″ broad at the ends of the branches. Tepals persistent, ·08–·1″ long, unequal, one or two outer suborbicular or ovate sometimes emarginate and inner whorl usually narrower. Stamens exserted, filaments persistent. Drupe globose with a produced base, ·2″ diam., red or finally black with black endocarp, 1-seeded, rarely more.

Deltaic forests of the Mahanadi, Cuttack! Fl. r.s. Fr. up to the following May.

FAM. 143. COMMELINACEÆ.

Annual or perennial herbs, rarely somewhat fruticose. Leaves with a midrib and more slender parallel nerves, sheath always present, rarely shortly petioled above the sheath. Inflorescence various. Flowers heterochlamydeous more or less irregular, usually 2-sexual. Outer perianth whorl sepaloid, often persistent, inner of 3 usually blue or red petals, often united into a tube at the base, marcescent. Stamens typically in 2–3-merous whorls, inserted at base of corolla, 2 or more often reduced to staminodes, filaments often bearded with jointed hairs, anthers oblong or globose, often dissimilar. Ovary superior, 2–3-celled with terminal style and small stigma. Ovules 1 or few axile, orthotropous. Fruit loculicidal or indehiscent. Seeds angled with smooth or rugose testa and copious floury albumen. Embryo minute in the periphery of the albumen, remote from the hilum.

The placentation is axile, the seeds showing a characteristic lateral (axile) umbonate or clypeal hilum, the ends where touching other seeds are truncate or even concave, the free end of the terminal seeds however often conical.

I. Fertile anthers 3–2, staminodes 3–4 :—
  Inflorescence few-fld. enclosed in large conduplicate spathes . 1. *Commelina.*
  Inflorescence not enclosed, bracts small . . . . . 2. *Aneilema.*
II. Fertile anthers 6 (rarely 5), staminodes 0 :—
  A. Petals combined into a tube below. Ovules usually 2 in each cell :—
    Sepals free. Fls. sometimes enclosed by large imbricating bracts or axillary . . . . . 3. *Cyanotis.*
    Sepals united into a tube. Not indigenous . . . . *Zebrina* (p. 1083).
  B. Petals free or nearly so. Ovary with one ovule in each cell :—
    Fls. sub-globose, secund on the branches of a close panicle.
      Ovary 2-celled . . . . . 4. *Floscopa.*
      Ovary 3-celled. Not indigenous . . . . . *Rhœo* (p. 1083).

1. COMMELINA, *L.*

Herbs, sometimes tuberous, usually slender and creeping below. Flowers emerging (usually only one at a time) from and retracted into a large spathaceous complicate bract or spathe, in few-fld. usually 2-nate or 2-fid cymes, those of upper branch deciduous, one or more of lower branch fertile, pedicel sharply recurved and thickened in fruit. Sepals 3, membranous, 2 inner often connate at the base. Stamens 3 perfect and 2–3 imperfect; anthers oblong, one usually largest. Ovary 3- rarely 2-celled, 2 cells 1–2-ovuled, third cell, if present, 1-ovuled or empty. Capsule loculicidal, or third cell inde-

hiscent or the 2 anticous cells empty connate indehiscent and forming a persistent ligulate body from which the posticous cell falls away. Seeds ellipsoid or angled, reticulate smooth pitted or rugose.

The ovary and capsule show a tendency to the more or less complete abortion of the posticous cell and its ovule (the fact that the cell never contains 2 ovules is a general case of this). The division into sections based on this tendency appears to me unnatural and to separate widely closely allied species so that I have not adhered to the usual grouping of the species.

I. Spathes complicate with dorsal margins free to the base :—
  A. Seeds reticulate, rugose inside the reticulations. Ovules 5. Capsule usually 5-seeded :—
    L. ovate-lanc. to lanc. Spathes ovate cordate ·75–·2″ . . . . . 1. *nudiflora.*
  B. Seeds smooth, often with a hoary bloom. Ovules 5–4 :—
    1. Capsule 3-celled (sometimes 2-celled in *salicifolia*):—
      L. linear or linear-lanceolate 3–6″ by ·17–·5″. Spathe lanceolate, usually acuminate. Seeds appendiculate . . . . . 2. *salicifolia.*
      L. lanceolate or oblong-lanc., 1·5–2·5″. Seeds muticous . . . . . 4. *Hasskarlii.*
    2. Capsule 2–1-celled. Ovules 2 in each cell :—
      L. linear 1·5–3″. Spathes lanceolate acuminate, hairy within. Seeds or seed appendiculate . 3. *attenuata.*
    3. Ovule 1 in each cell. Capsule 2–3-celled . . *appendiculata* (p. 1076).
II. Spathes funnel-shaped or with the margins connate nearly to the top, never acuminate :—
  A. Ovules 5. Capsule 3-celled, 2 cells usually 2-seeded :—
    L. ovate 1–3″. Spathes 1–3 together . . . 5. *benghalensis.*
  B. Ovules 3–2. Capsule 3–2-celled. Stout species with spathes crowded to subsolitary :—
    Spathe ·75″. Cap. 3-celled, dorsal scabrid. Seed white-margined . . . . . 6. *Kurzii.*
    Spathe ·75–1·5″. Cap. 3- (rarely 2-) celled. Seed grey smooth compressed . . . . . 7. *obliqua.*
    Spathe ·3–·7″. Cap. 2-celled. Seeds with large pits. 8. *suffruticosa.*

1. C. nudiflora, *L.* Syn. C. communis, *Clarke,* in Comm. & Cyrt. Tab. 1.

A rather succulent creeping herb with sheathing lanceolate leaves 1–3″ long, usually glabrous with hairy sheaths ·5–·75″ long. Flowers blue considerably exserted from the conduplicate spathe, in 2-forked cymes, the upper branch often with 2 barren flowers, the lower with usually 3 fertile flowers all retracted into the spathe after fertilization. Capsule 3-celled, 2 cells 2-seeded, 1 cell 1-seeded keeled deciduous. Seeds rugose-reticulate, the rims of the reticulations subhexagonal continuous, the depressions minutely granular.

Common in damp grassy places. Singbhum ! Probably in all districts, at least in the more humid ones, but very poorly represented in herbaria. Fl., Fr. Aug.–Oct.

Rooting at the nodes. L. sometimes only ·8″ and ovate-lanceolate, sometimes scabrous or puberulous (*Clarke*) and ciliate. Spathes ·75–2″ long ovate cordate (when unfolded) or base rounded, tip sometimes acuminate. Peduncle of spathe ·5″–·75″. Fls. about ·5″ diam. Sepals green, 2 anterior larger. Petals blue or outer pale or white. The far-exserted cyme branches are rather characteristic, and often 2 fls. open at once.

2. C. salicifolia, *Roxb.*

Stems diffuse with long branches and internodes and leaves linear-lanceolate or almost grass-like, 3–6″ by ·17–·5″, glabrous or nearly so, sheaths ciliolate. Flowers of a most intense blue, smaller than in

nudiflora, 1–2 on the cyme branches, which are usually considerably exserted. Spathe complicate lanceolate, axillary solitary, often acuminate. Seeds smooth black with a white bloom, 2 anticous cells of capsule 2-seeded and posticous usually 1-seeded as in *nudiflora* but third cell sometimes obsolete.

Wet or watery places, frequent. Jalpaiguri (and probably Purneah)! Bengal, many times collected. Chota Nagpur, *Clarke*. Parasnath, *Cal. Herb.*! Also Northern Madras, so that it probably extends throughout the province.

L. sessile on their cylindrical sheaths, a little hispid on the upper side and margins (*Roxb.*). Petals equal except that the lower has a shorter claw. Capsule oblong, shortly suddenly acute. Seeds subglobose truncate, appendiculate.

Some states closely resemble *C. attenuata*, to which it must be very closely allied.

3. **C. attenuata,** *Koen.* Syn. C. Rajmahlensis, *C. B. Clarke* (in Comm. & Cyrt.) ?

Small, diffuse with slender stems and branches angled, usually with a line of short pubescence. Leaves linear, mostly conduplicate, or slightly tapering to one end or the other, acute or acuminate, 1·5–3″ long by 1·5–·3″ broad, midrib and marginal nerves prominent, glabrous. Sheath cylindric, ·25–·3″ long, about 6-nerved, margins thinly pubescent. Spathes (when opened out) lanceolate long-acuminate, the acumen longer than the rest, sub-sagittate with rounded auricles, copiously minutely dotted, sparsely hairy within, glabrous outside (or with some long white hairs in Parasnath specimen), ·8–1·4″ long, margins not coherent, sometimes closely ciliate. Flowers very small, deep blue with brownish lower sepal. Capsule oblong ·27″ long, retuse, 2–1-celled, each cell 1–2-seeded. Seeds ·1″ long (excluding the prominent pale soft process each end), brown, subterete, with a line down one face at right angles to the scar, truncate and appendaged each end, one appendage minutely toothed.

Rajmahal Hills, *S. P. Kurz*! Ranchi, *C.B.C.*! Hazaribagh (Parasnath), *C.B.C.*! Manbhum, *C.B.C.*! Angul, *Chatterjee*! Fl., Fr. Oct.–Nov.

This species is very closely allied to *C. salicifolia* and *C. appendiculata*, *Clarke*, and appears to show that too much importance has been attached to the more or less complete suppression of the third loculus in the fruit. *Clarke* says "close to *C. Hasskarlii*, differs by the 4 ovules (never ?) 5, by the appendiculate seeds, 2–3 frequently abortive." In his *Commelynaceæ* he also says under *C. rajmahlensis*. close to *C. appendiculata*, but in which the spathes are less elongate, less hairy and the seeds much smaller. But although *C. rajmahlensis* is given as a synonym in *Clarke's* Monograph and in *F.B.I.*, the figure in the *Commelynaceæ* shows a distinctly 3-celled capsule and 3 muticous seeds!

In my specimen the flowers are only just exserted from the very narrow beaked spathe. The capsule is retuse instead of shortly beaked, but I have been unable to confirm the constancy of this character as the capsules in herbaria are mostly mutilated. *Hooker* (in *F.B.I.*) restricts the species to plants with leaves only 1–2″ long, recurved, and 1-celled capsules.

C. appendiculata, *Clarke*, is found in the Darjeeling Tarai and may therefore be found in Purneah. The plant is in general larger than *attenuata* but this may be due to the forcing locality. Spathes 1·5–2·5″ copiously minutely dotted. Capsule ·25″ not retuse. Seed 1 in each cell, more elongated and less truncate, ·14″.

4. **C. Hasskarlii,** *Clarke.*

Stems diffuse, creeping and rooting at the base, glabrous (or pubescent, *Clarke*), or sometimes a few short hairs below the nodes. Leaves

lanceolate or oblong-lanceolate, subacute or obtuse, 1·5–2·5″ long by ·3–·6″ broad, glabrous (or sparsely ciliate, *Clarke*), rather suddenly contracted to the ovoid inflated conspicuously 7–10-nerved pale ·3–·5″ long sheath which has ciliate margins. Spathe ·6–1″ long with a peduncle ·3–·5″ long when unfolded, ovate-lanceolate or ovate and slightly acuminate, complicate, margins free to base, deeply cordate with 4–5 principal nerves each side of ciliate midrib, glabrous or midrib ciliate and margins hispidulous. Peduncle ·3–·5″ long, pubescent along upper side. Capsule only one developing to each spathe, ·3–·4″ long, oblong shortly beaked, with 2 widely dehiscent cells and one smaller, very tardily dehiscent cell more or less keeled. Seeds usually 2 in each of the larger cells, brown-black with a hoary sheen, oblong and obscurely keeled, minutely reticulate, ·14″ long.

Singbhum! Ranchi, *Clarke*! Hazaribagh, *Clarke*! Angul! Fl. Sept.–Nov.

Close to *C. salicifolia*, differing by the broader leaves, inflated sheaths, less acuminate spathes rarely over ·8″, inappendiculate seeds truncate one end, subacute the other. But I have a specimen with seeds very slightly appendiculate. The habit is often rather characteristic from the axillary shoots bearing many leaves and smaller than those of the parent stem.

5. **C. benghalensis,** *L.*

Stems sub-succulent, creeping and rooting below, glabrous or pubescent, often pilose below the nodes. Leaves ovate or elliptic-ovate 1–3″ by ·5–1·5,″ obtuse or rounded at the tip, suddenly contracted or rounded at base. Sheaths pubescent or villous or both and usually with long hairs at mouth extending on to a short petiole. Spathes 1–3 together, conduplicate with the margins connate for a considerable distance at the base, turbinate or conical in form and with very short apex, only ·3–·6″ long and as broad. Capsule membranous, 2 cells 2-seeded dehiscent, third smaller 1-seeded, tardily dehiscent striolate. Seeds rugose, closely pitted.

Very common in damp places. Gaya, *Nusker*! Chota Nagpur, all districts; Santal Parganas, *Kurz*! Orissa, *Hooper*! Probably in all districts of the province. Fl., Fr. July–Nov.

L. sometimes hairy, sometimes sessile on the sheath, but usually with short petiole, base often ciliate. Cymes 2-nate, one with 2–3 fls., the other with 1, rarely 2 fls., sometimes 0. Fls. small blue, appearing (as in others of the genus) one at a time. Ovoid cleistogamous underground flowers ·25″ long often occur on bracteate peduncles near the root.

The plant is eaten as a pot-herb.

6. **C. Kurzii,** *Clarke*. Possibly a variety of C. obliqua and C. suffruticosa. *Clarke* says "somewhat doubtfully distinct from *obliqua* but the mealy piloseness of the leaves generally enables *Kurzii* to be separated without reference to the capsules." The capsule is 3-celled, 2-valved, the dorsal cell indehiscent, deciduous and scabrid. Seeds sometimes 2 only.

Rajmahal Hills, *Kurz*! Fl. May.

The leaves are finely hoary-pubescent as are the sheaths and spathes. Spathes about ·7″ across the top. Seeds sometimes with very white corrugate edges.

7. **C. obliqua,** *Ham.* Probably a variety of and synonymous with C. Kurzii, *Clarke*, and C. suffruticosa, *Blume* (*q. v.*).

A stout species with branched stems 2–3 ft. straggling among bushes. Leaves very variable 4–7″ by 1–2″ lanceolate acute or caudate,

glabrous pubescent or villous beneath, sheaths ·75″, margins often bearded. Spathes ·75–1·5″ long and broad, in crowded heads, rarely solitary, funnel-shaped, *i. e.* the margins on both sides connate nearly to the top. Capsule obovoid, 3-gonous, 3-valved and -celled, with one seed in each cell about ·13″ long and usually somewhat compressed on one side.

Throughout India, *J.D.H.* Sikkim Tarai, *J.D.H.*! Monghyr, *Wall*, 8985C (part). Ranchi, *Prain*! Hazaribagh (Parasnath), *T. Thoms.*!

This appears to be another case of very closely allied (if not the same) species being widely separated by the number of cells in the ovary and capsule. In this connection I may recall that *Clarke* in his *Commelynaceæ* says: "I have frequently met 3-celled and 2-celled fruits on the same plant, the 2-celled fruits being without a trace of the third cell." This is my experience, and my *suffruticosa* from Neterhat appears to be this species (if they are distinct) with 2-celled capsules. In a sheet of *Wallich's* (see above) one scrap only has been called "*obliqua*" by *Clarke*, the rest "*suffruticosa*." I think they are all possibly one collection. In this the spathes have long hairs on the faces.

8. **C. suffruticosa,** *Blume.*

A stout branching and scrambling species with creeping rhizome and fleshy roots. Stems polished, up to ·4″ diam. with thickened nodes. Leaves large sessile on the 1–1·3″-long ciliate sheaths, lanceolate finely acuminate with unequal base, scaberulous above, margins scabrid, larger about 7·5″ by 2″ (in my plant; 3–14″ by ·75–2″, *Clarke*). Spathes usually much smaller than in the last two, about 3·7″ long and broad and usually villous, panicled or clustered. Capsule 2-celled. The seeds are said to be straw-coloured and fascetted or with large pits (but I doubt their being ripe).

Bettiah, *Hieronymus* (with very long hairs in leaf axils and margins ciliate)! Monghyr, *Wall* (part No. 8985C, spathes ·7 by ·8″)! Singbhum, *Clarke* (spathes few, ·7″. Capsule retuse 2-celled)! Ranchi (Neterhat, but spathes ·9″ by ·8″, obtriangular, truncate, with very short acumen)!

My specimen from Neterhat, to which most of the description above applies, the only one with undoubtedly ripe seeds, is essentially *C. obliqua* with 2-celled 1–2-seeded capsules ·17 by ·15″ compressed on sharply reflexed pedicels; seeds oblong grey with a matt minutely papillose surface, ·15″ long, not at all rugose! If the capsule character be omitted the only distinction left between *suffruticosa* and *obliqua* are the smaller more villous spathes and doubtfully the seeds.

2. ANEILEMA, *Br.*

Herbs, sometimes tuberous. Flowers and fruit not enclosed in a large spathaceous bract, in axillary and terminal panicles with ordinary bracts and bracteoles. Sepals 3, membranous. Petals equal obovate. Stamens 2 or 3, filaments naked or bearded, anthers oblong, one usually smaller or larger than the others; staminodes 2–4, rarely with minute polliniferous anthers. Ovary sessile, 2–3-celled. Ovules 1–2-many. Capsule loculicidal, cells 1- or more-seeded. Seeds with a thick hard rugose or pitted testa.

I. Flowers cymose and panicled:—
  A. Panicles on a leafless scape appearing before or with the young leaves. Flowers ·75″ diam. . . . 1. *scapiflorum.*
  B. Cymes or panicles on the leafy stems:—
    1. Stout species with oblong or ensiform leaves mostly 6″ or more. Capsule-cells 3–4-seeded . . 2. *lineolatum.*

2. Slender diffuse species with small or narrow leaves 1–6″:—
Ovules and seeds 3–7 in each cell. L. under 2″ . 3. *spiratum.*
Ovules and seeds 2 in each cell. L. 2–5″ . . 4. *nudiflorum.*
II. Fls. 1–4 clustered on short axillary peduncles:—
Ovules and seeds about 16 in each cell . . . . 5. *terminalis.*
Ovules and seeds solitary in each cell . . . . 6. *vaginatum.*

1. A. scapiflorum, *Wight.*

A very beautiful little plant throwing up its scapes after the jungle fires and before the appearance of the leaves. Flowers purple-blue or sepals red and petals violet, ·75″ diam. on a narrow panicle 8–18″ high. Stamens 3 perfect with purple anthers, staminodes 2 or 3 shorter with small yellow anthers, filaments bearded. Capsule ·25″ elliptic mucronate 3-gonous. Ovary-cells mostly about 4–5-ovuled.

Frequent in grass tracts annually burnt and also in sparse forest. Common in Chota Nagpur! Purneah! Mayurbhanj! Kalahandi! Probably in all districts. Fl. March-May. Leaves appear with the rains (May in Mayurbhanj).

Tuberous roots numerous elongate from a thickened small stock. L. narrowly ensiform, 4–10″, erect, finely acuminate. Lower bracts of panicle 1″ long, tubular or amplexicaul, often with erect panicle-branches, upper ovate ·2–·15″ usually dotted and puberulous. Petals sometimes ·5″, obovate or suborbicular. Seeds straw-coloured with a minutely reticulate glandular epidermis, 1-seriate, 3–6 superposed in each cell.

The tuberous roots are credited with various medicinal properties.

2. A. lineolatum, *Kunth.* Syn. A. herbaceum, *Clarke* (in Monog.).

A stout species with erecto-patent large lanceolate or oblong amplexicaul leaves 6″ by 1·5″ or radical up to 12″. Flowers blue in large axillary and terminal panicles with marcescent bracts. Filaments all bearded. Capsule broadly ellipsoid 3-gonous, ·25″ diam., mucronate, with 3–4 smooth reticulate seeds in each cell.

Chiefly in Eastern India and the hills. Ranchi (Hundrughagh), *Prain*! and Bundu (Tamar), *Wood*! Hazaribagh (Parasnath), *Thoms.*! Fl., Fr. Aug.–Sept.

L. with white margins, acuminate, often crisped, base cuneate rounded or cordate. Panicle stout glabrous with spreading and ascending branches. St. 2–3 with 2–3 staminodes. Seeds glandular-puberulous (*F.B.I.*).

3. A. spiratum, *Br.*

A procumbent or ascending much branched slender herb with amplexicaul small oblong to somewhat ovate or lanceolate leaves up to 2″ long and small bright blue or violet flowers ·25″ diam. in axillary and terminal panicled scorpioid cymes with the rhachis often zigzag. Bracts minute persistent. Pedicels slender ·25″. Sepals brownish. Petals obovate ·17″. Capsule oblong ·15″ long, acutely trigonous mucronate or shortly beaked with a single row of 3–7 seeds in each cell. Seeds cuboid, shining, light brown, minutely knobbed (smooth or scaberulous, *F.B.I.*).

Common, mostly in drying-up rice-fields. Purneah, *Kurz*! Gya, *Thoms.*! Chota Nagpur, all districts! Probably throughout the province. Fl., Fr. Sept.–Jan. Annual.

Root fibrous. Stems many from the root 6–15″ with the panicle. Branches with a line of pubescence. Leaves mostly ·5–1·5″, usually glabrous, acute or subacute, margin thickened often scaberulous. Sheaths short with pubescent edges in continuation of the branch lines of pubescence. St. 3, staminodes 3, filaments naked or bearded.

4. **A. nudiflorum,** *Br.*

A herb with many slender branches decumbent and rooting or ascending. Leaves linear or linear-lanceolate, 2–5″ by ·15–·4″ rarely ·5″ broad, acute or sub-obtuse, sheath bearded. Flowers small, blue or purplish in terminal or leaf-opposed few-fld. cymes, cymes becoming paniculate with elongate peduncles marked with the scars of fallen bracts at the cyme. Ovary with cells 2-ovuled. Capsule broadly oblong-ellipsoid, mucronate, ·15″ long, each cell with 2 broadly oblong very rugose and pitted seeds, truncate at their common end, rounded or obtuse at the other, nearly as broad as long.

A common weed. Near Purneah, *Kurz*! Santal Parg., *Kurz*! Singbhum! Ranchi, *Prain*! Manbhum, *Wood*! Probably throughout the province. Fl., Fr. r.s.

L. glabrous in our specimens, sometimes hairy or subvillous (*F.B.I.*). Fls. on pedicels ·1–·2″ long. St. 3 fertile with bearded filaments, 3 staminodes with filaments bearded or not.

In var. *compressa*, *Clarke* (not so far reported from our area), the seeds are 3 in each cell.

5. **A. terminalis,** *comb. nov.* Syn. A. Hamiltonianum, *Wall.*; Tradescantia terminalis, *Blume* (1827).

Diffuse but less branched than *spiratum* with creeping and rooting stems 6–12″. Leaves suberect linear-lanceolate, often complicate, amplexicaul 1–3″ by 1·2–2·2″, nearly glabrous. Flowers more or less concealed in the leaf-bases, pedicels jointed. Ovary many-ovuled. Capsule oblong shining ·25″ long with about 16 seeds in each cell.

Sarguja, *C. B. Clarke*! Also in United Provinces (Moradabad) and Goalpara, so probably throughout our northern area. Fl. Sept.–Oct.

L. acute or subacute. Flowers white or pinkish. Filaments naked. Peduncle under ·25″.

The oldest specific name is *terminalis*, but this was subsequently utilized by *Wight* for a different plant subsequently reduced by *Clarke* to a variety of *A. nudiflorum*.

6. **A. vaginatum,** *Br.*

A slender grass-like herb with erect and prostrate branches from near the root 6–18″ long often rooting at the nodes. Leaves 2–6″ long by ·3–·4″ broad. Flowers small purple-blue star-like, ·25″ diam., 1–3 rarely 4 together in the axils of distant convolute bracts. Stamens 2 perfect and 3–4 with aborted anthers, bearded with long purple hairs (or naked, *F.B.I.*). Capsule 3-celled and -seeded, ·12–·16″ diam. subglobose, glabrous.

Very common in wet ground. Purneah, *King*! Chota Nagpur, all districts! Probably throughout the province as it is common in the Deccan, etc. Fl., Fr. July–Oct.

Stems striate, often puberulous. L.: upper reduced to bracts and erect, sheaths short open pubescent. Pedicels ·5–·75″ on a short peduncle, scarcely exserted from the bract, "twice jointed in the middle" (*F.B.I.*). Seeds hemispheric, black, rugose. Sepals pubescent, narrow, persistent, equalling the petals. Petals broader, ovate or oblong.

3. CYANOTIS, *Don.*

Herbs, usually prostrate or creeping, sometimes tuberous. Flowers rarely clustered in the leaf sheaths, usually 2-seriate secund on the

stout curved rhachis of axillary and terminal small helicoid cymes and enclosed in the biseriate falcate imbricating bracts, the petals and stamens, rarely the whole flower exserted, very rarely in exposed racemes. Sepals subequal, free or connate below. Petals subequal, often united into a tube below. Stamens 6, all perfect subequal, filaments usually bearded, often expanded towards the apex, anthers oblong. Ovary 3-celled; ovules 2 collateral in each cell, one erect, the other pendulous. Capsule 3-celled, loculicidal. Seeds superposed, cuboid or pyramidal, usually rugose.

A. Flowers in the axils of the leaf-sheaths . . . . . 1. *axillaris.*
B. Flowers in spiciform scorpioid cymes with pairs of secund closely imbricating foliaceous bracts :—
Root fibrous. Bracts glabrous or villous on the margins only . 2. *cristata.*
Root of fascicled tubers. Bracts villous all over . . . 3. *tuberosa.*

1. C. axillaris, *Roem. & Sch.*

A glabrous sub-succulent creeping and rooting herb with numerous erect and spreading branches often 2 ft. long with sheathing linear acuminate leaves mostly 3–4″ long, lower up to 5″ by ·5″, floral ·5–1″ long. Flowers pretty, bright blue in short axillary clusters in the inflated leaf-sheaths, 1–6 in each axil, ·75″ long and ·3″ diam. Calyx ·3″ long, split about half-way into 3 narrow greenish or hyaline segments, keeled in fruit. Cor.-tube very slender ·5″, petals ovate. Filaments with long blue jointed hairs, clavate at tip. Capsule ·2″ long, glabrous, acute, 6-toothed or -lobed (each valve being 2-fid). Seeds sub-cylindric, punctate.

Very common in rice-fields and other wet places. In all districts! Fl., Fr. July–Jan. Annual.

Stems shining, glabrous or sparsely hairy. L. tapering from base to apex. Fls. sometimes white or violet. Top of filament clavate. Anths. yellow, oblong, inserted near base, cells with convolute walls, pollen purple. Style filiform spiral, clavate above.

2. C. cristata, *Schultes.*

Stem slender branched creeping below, root fibrous, branches erect or ascending glabrous or patently hairy. Leaves rather distant sessile spreading 1·25–3″ by ·5–·75″, ovate-oblong. Cymes recurved not clustered, ·5–·8″ in the axil of a lanceolate spathe which usually greatly exceeds the spike and is 1–1·5″ long. Bracts imbricating, ·4–·6″ long by ·17–·2″ broad, very falcate obtuse and apiculate, glabrous or with margin only villous.

In wet ground. Gaya, *Nusker*! Rajmahal Hills, *Kurz*! Chota Nagpur, *Wood* (without locality)! Parasnath, *Cal. Herb.*! Manbhum, *Thoms.*! Fl. Oct.

Stems 1–2 ft., pubescence sometimes confined to a line decurrent from the sheaths. L. rather fleshy, obtuse or subacute, usually densely ciliate and with short hirsute sheaths. Flowers blue, sepals linear-oblong acute hairy, filaments bearded, clavate below the tip. Capsule ·1″, slightly hairy above. Seeds 2 in each cell, conic-oblong, truncate at their mutual extremity, other end umbonate, slightly ribbed and warted (3-gonous, striate and pitted, *Clarke*).

3. C. tuberosa, *Schultes.*

Flowering stems stout prostrate ascending and erect, 12″ to 2 ft. high, hirsute at the base, hairy above. Leaves mostly radical, ensiform, or narrowly oblong, 5–10″ by ·4–1″, subacute, without costa,

shining and with sparse long silky hairs beneath, margins densely villous or woolly, cauline sheaths often inflated, silky. Spathes oblong-lanceolate ·5–·6″ usually shorter than the spiciform recurved cymes, which are mostly clustered in several-nate heads. Bracts falcate dimidiate-cordate, acute, ·3–·5″ long by ·17–·2″ wide, very villous outside, sessile, each pair enclosing 2 (or more ?) sessile flowers with linear-oblong or lanceolate villous or hirsute sepals ·3″ long. Capsule broadly oblong ·13–·15″ hairy above, each cell with 2 broadly conical seeds with an umbonate base and truncate or depressed mutual apex, rugose.

Singbhum, in the forests and under bushes! Fl. r.s. Fr. Sept.–Oct.

Tubers elongate fascicled (resembling those of *Aneilema scapiflorum*). Leaves often purple beneath. Petals blue-purple. Filaments bearded with tumid tip.

Var. *adscendens*, *Clarke*. Smaller, far less hairy, branches rooting and proliferous at the nodes. Heads and spathes smaller.

Chota Nagpur, Ranchi, *Clarke*! Singbhum!

The roots are eaten. Under the Santali name *Hodo jereng arak*, *Campbell* states that "the root is given in long-continued fevers and also for worms in cattle. The leaves are eaten as a pot-herb."

4. FLOSCOPA, *Lour.*

Erect or subscandent herbs with flowers in secund cymes in axillary or terminal thyrsoid panicles. Sepals 3, free, oblong. Petals free, obovate. Stamens 6, perfect (rarely one imperfect), filaments glabrous. Ovary 2-celled, style simple. Ovules one only in each cell. Capsule 2-celled, loculicidal, crustaceous. Seeds hemispheric.

1. F. scandens, *Lour.*

Not scandent in our area but erect and gregarious with stems creeping below. Leaves sessile (or petioled, *F.B.I.*) on the bearded or ciliate sheaths, 2–4 by ·4–1″, elliptic-lanceolate, acuminate, base narrowed. Flowers lilac, in dense terminal panicles 1·5–2″ long, branches, pedicels and calyx closely glandular-hairy or hirsute.

Wet places or in water. Purneah! Ranchi and Palamau, elev. 3000 ft.! Fl., Fr. Sept.–Nov.

Glabrous or thinly pubescent on stems and leaves, sheaths always hirsute or bearded on margins and mouth, ·6–·8″ long. Panicles shortly peduncled, broad-ovoid or pyramidal. Flowers subglobose, lower bracteate, sometimes white or pink. Petals broadly obovate. Filaments purplish, anthers yellow. Capsule subglobose, ·08″, about equalling the calyx. Seeds pale-glaucous.

Rhœo discolor, *Hance* (called *Tradescantia discolor* in horticultural works) is an erect plant 1–2 ft. high commonly grown in pots in verandahs, etc., with somewhat the habit of a dwarf *Agave*, the leaves being close sessile ensiform rather stiff and erecto-patent, deep green with crimson undersurface and sometimes coloured margins. The flowers are small white numerous in cymes enclosed in axillary spathes. Capsule enclosed in the marcescent perianth, cells 1-seeded.

"Grows in deep coppices," Mexico.

In true *Tradescantia* the ovary-cells are 2-ovuled and seeds usually 2 and flowers in short racemes.

Zebrina pendula, *Schnizl.* (usually called *Tradescantia zebrina*, *Hort.*) is a pretty creeping and rooting herb with rather glistening ovate leaves marked with pale or silvery and dark stripes, underside purple. The flowers are small red-purple enclosed in a spathe. Stamens 6 inserted in the mouth of the corolla-tube. Ovary-cells with 1–2 ovules in each. Native of Mexico.

SERIES.—LILIIFLORÆ.

FAM. 144. JUNCACEÆ.

Erect, usually perennial herbs with stems usually tufted on a creeping rootstock (in one of our species annual). Leaves flat or terete or reduced to sheaths. Flowers green, or whitish and membranous, or brown and scarious or coriaceous, bracteate in axillary or terminal cymes, 2-sexual. Perianth inferior, tepals in two whorls, persistent, imbricate. Stamens 6, rarely 3, hypogynous or partly adnate to the tepals, anthers basifixed. Ovary 1–3-celled, style filiform or short or 0, stigmas 3 filiform. Ovules many axile in the 3-celled, 3 only and basilar in the 1-celled ovary, anatropous. Capsule 1–3-celled, loculicidally 3-valved. Seeds erect, testa membranous, often produced at each end; albumen dense, embryo small, next the hilum.

1. JUNCUS, *L.* Rush.

Glabrous. Leaves sometimes septate within. Perianth with the outer segments keeled or the midrib thickened. Stamens 6, rarely 3. Ovary 3-, rarely 1-celled, ovules many.

Annual. Stems copiously dichotomously branched. L. not septate . . . . . 1. *bufonius.*
Perennial, strict, cæspitose. L. distantly septate . . . . 2. *prismatocarpus.*

1. **J. bufonius,** *L.* Toad-rush.

A densely tufted much dichotomously and sometimes 3-chotomously branched very slender herb 1–10″ high. Leaves few, chiefly near the base of the stems, grass-like, very narrow concave above, 1–4″ long. Flowers pale green solitary, in the forks of the cymes and unilateral in helicoid often flexuous cymes. Bracts scarious less than half length of perianth, outer tepals ·2″ long, lanceolate acuminate with membranous margins, inner about ⅔ths as long, similar. Capsule oblong or slightly obovoid ·12″, at first closely embraced by the perianth, when quite ripe loculicidal and septifragal and the axis again splitting into three. Seeds very numerous oblong ·02″ long, yellow, sometimes with black tip and finely reticulate.

In the Upper Gangetic plain! and extending eastwards to Beauleah, *Clarke!* Fl., Fr. c.s. This little rush is common in Europe. No specimens appear to have been collected actually inside our area, but from its distribution it is sure to occur in the northern area.

2. **J. prismatocarpus,** *Br.*

A variable cæspitose erect (or in one variety prostrate) rush 10–24″ high. Stems terete or compressed, not septate. Leaves soft terete or compressed tubular or with several tubes, distantly septate. Cymes terminal erect with erect or spreading branches bearing the flowers densely clustered in hemispherical heads. Fls. green or brown, outer tepals scarious ·12–·17″ long, subulate or linear-lanceolate. Stamens 3 much shorter. Style very short. Capsule prismatic or conical, usually much exserted from the perianth.

In wet places. Bengal, *J.D.H.* (without district)! Purneah (Kissenganj), *J.D.H.*! Santal Parg., *Kurz*! Gangpur, *Prain's Collector*! Fl. May. Perennial. Rootstock very short. Stems sometimes decumbent and rooting at the nodes. Leaves 2–10″, shorter than the stem, sometimes filiform, but attaining ·12″ in width. Lower bract of cyme erect foliaceous, shorter than cyme, floral bracts hyaline, lanceolate acuminate. St. very short. Seeds minute, apiculate, testa appressed reticulate.

FAM. 145. LILIACEÆ.

Mostly perennial herbs with underground rootstock or bulb, sometimes climbing, more rarely suffruticose or shrubs or trees with a secondary growth in thickness. Leaves various, cauline or radical, sometimes reduced to scales with their function assumed by leaf-like cladodes (*Asparagus*), sometimes fleshy, usually parallel-veined. Flowers 2-sexual, rarely 1-sexual by abortion, regular, rarely somewhat irregular, axillary or in a terminal scape which is 1–2-fld. or sometimes umbellate, spicate, racemose or panicled. Bracts various (rarely spathiform under an umbel as in so many Amaryllidaceæ). Perianth inferior and free from the ovary, petaloid, often marcescent, tepals combined into a tube at the base or free, in 2 series of 3 each, both series similar or very slightly different, occasionally tepals 4, 8 or many, slightly imbricate or outer valvate. Stamens most usually 6 hypogynous or on the perianth opposite the lobes, filaments free or connate, anthers variously affixed to the filaments with usually 2 longitudinally dehiscent cells rarely with terminal pore. Ovary superior, 3-celled with axile placentation, occasionally 1-celled with parietal placentation, rarely 2- or 4-merous with 2- or 4-merous perianth, style and stigmas various. Ovules in each cell 2 collateral or many 2-seriately superposed, rarely solitary or numerous and irregular, anatropous, hemianatropous or in a few genera orthotropous. Fruit baccate or septicidally or loculicidally capsular or rarely irregularly rupturing. Seeds with copious albumen. Embryo minute globose or elongate, sometimes much shorter than the albumen, straight or slightly curved, radicular end near or remote from the hilum.

I. Arboreous, shrubby suffruticose or climbing or if erect and herbaceous, then flowers irregularly panicled. Rootstock never bulbous. Fls. never in involucrate umbels or solitary (exc. *Gloriosa* and then stem elongate climbing):—
  A. Fls. very small, often umbelled. Stems branched often prickly, usually scandent and suffruticose. L. not elongate:—
    L. 3–9-costate, reticulate-nerved between. Fl. umbelled . . . . . 1. *Smilax.*
    L. scale-like with acicular cladodes in their axils. Fls. mostly racemose . . . . . 2. *Asparagus.*
  B. Fls. large or mod.-sized. L. usually elongate or fleshy. Stem not scandent (exc. *Gloriosa*):—
    1. Woody plants or with thick fleshy leaves densely clustered and often spinose. Fls. racemose. Anthers introrse:—
      a. Ovule 1 in each cell (*Sanseviera* is usually placed in Hæmodoraceæ):—
        Stem slender elongate (in our species). Perianth funnel-shaped or narrow-campanulate. Berry 3–1-celled, pericarp persistent . . . 3. *Dracæna.*

Stems subterranean, rhizomatous. Fruit sub-3–1 coccous, pericarp evanescent . . . 4. *Sanseviera.*
b. Ovules many in each cell. L. usually thick and spinose :—
i. Filaments not inserted in a pit in the connective :—
Fls. relatively small, panicled, tube short. Frt. baccate . . . . . 5. *Cordyline.*
Fls. large, tepals nearly free, anths. small on a thick filament. Frt. capsular or baccate . 6. *Yucca.*
ii. Fil. inserted in a pit in the connective :—
Tepals connate or conniving nearly to tip. L. spinous . . . . . 7. *Aloe.*
2. Scarcely woody with short rhizome. L. not very thick, often distichous. Ovules many (2–6 in *Disporum*) :—
a. L. linear elongate. Rhizome short woody :—
Fls. few large erect irregularly panicled, funnel-shaped with short tube. Fil. inserted in a pit. Frt. 3-gonous . . . . . *Hemerocallis* (p. 1092).
Fls. mod.-sized laxly cymose on the panicles. Tepals free, filaments thickened. Frt. baccate 8. *Dianella.*
b. L. short or tips cirrhose. Rhizome tuberous or creeping. Anthers extrorse :—
Erect. Fls. sub-umbellate on recurved pedicels. 9. *Disporum.*
Scrambling or climbing. Fls. large axillary solitary . . . . . 10. *Gloriosa.*

II. Herbaceous with rootstock a bulb or corm or very short with a fascicle of tuberous roots (roots fibrous in *Asphodelus*). L. mostly radical (exc. *Iphigenia*). Fls. in involucrate umbels or radical racemose scapes :—
A. Fls. in heads or umbels sheathed by 1–more spathes (cultivated only in our area) :—
Rootstock with many very fleshy fibres. Fls. large blue (rarely white) . . . . . *Agapanthus* (p. 1094).
Rootstock a tunicate bulb. Fls. small or mod.-sized Odour characteristic (alliaceous) . . . . 11. *Allium.*
B. Flowers racemose or fascicled in racemes (in axils of leaf-like bracts in *Iphigenia*) :—
1. Rootstock a bulb or corm :—
a. Fls. on a leafless scape :—
L. appearing after the fls. Seeds flattened . 12. *Urginea.*
L. and fls. coætaneous. Seeds globose or ovoid 13. *Scilla.*
b. Raceme leafy or fls. subcorymbose . . . 14. *Iphigenia.*
2. Rootstock small with many fleshy or tuberous roots or root annual :—
a. Ovules 2 in each cell. Seeds wrinkled . . 15. *Asphodelus.*
b. Ovules 4 or more in each cell :—
Raceme often dense. Capsule prominently 3-angled . . . . . 16. *Chlorophytum.*
Raceme very lax. Capsule not prominently 3-angled . . . . . *Anthericum* (p. 1099).

1. SMILAX, *L.*

Shrubs (rarely herbs) usually climbing by their twisted petioles and by the 2 stipular tendrils produced from above their leaf-sheaths. Leaves alternate, rarely opposite, persistent, 3–5-basal or sub-basal-nerved and reticulate, petiole short, often articulate above the tendrils, sheath often dilated. Flowers small, usually greenish or white, dicœcious, in umbels, umbels solitary or panicled. Tepals free, 6. Male fl. with usually 6 (sometimes more) stamens at the base of the perianth, free ; anthers didymous, oblong or linear-oblong, or the

cells separated by a forking of the filament. Fem. fl. with 3 or 6 staminodes. Ovary 3-gonous, 3-celled; style short or stigmas sessile, stout recurved. Ovules 1 or 2 in each cell, orthotropous, pendulous. Fruit a globose or ellipsoid berry. Seed solitary, or more often 2 hemispheric, rarely 3; albumen horny. Embryo small.

I. Umbels solitary. Stems unarmed or nearly so. Branches unarmed. L. under 6″, membranous, 3-costate . . 1. *lanceæfolia.*
II. Stems prickly, branches prickly or not. Umbels rarely solitary. Leaves mostly over 6″ :— . . . .
A. Umbels 1–3, rarely 5. Sheath not large nor auricled :—
Branches terete. L. 6–12″, usually very broadly ovate, 5–9-costate . . . . . 2. *macrophylla.*
Branches 4-angled. L. under 7″, elliptic or ovate-lanceolate, 3–5-costate . . . . . *zeylanica* (p. 1087).
B. Sheath with large auricles which often embrace the branch :—
Umbels 1–3 very unequally peduncled . . . 3. *Roxburghiana.*
Umbels many, usually verticillate on rhachis . . 4. *prolifera.*

1. S. lanceæfolia, *Roxb.*

A slender wiry unarmed climber, branches terete or with fine raised lines, not angular. Leaves oblong or ell.-oblong or some ovate-oblong, thin, only up to 3″ by 1·4″ in our specimens, sometimes 4–6″ by 1·5–3″, base obtuse or acute, glossy both sides and slightly translucent-dashed when fresh. Petiole ·5″, sheath obscure, tendrils from the sides of the older petioles. Umbels solitary axillary, peduncle of inflorescence ·2–·3″ long with small bracteoles separating it from the proper peduncle of the umbel which is ·3–·4″ long and pedicels about the same. Berry ·3″ diam.

Ramnagar Hills! Fl. r.s. Fr. Nov.

Rather a variable plant if specimens outside our area are considered, with stems sometimes slightly prickly and some leaves broad. The peduncle of umbel not always differentiated into general and special. Male umbels ·7–·9″ diam. and their peduncles usually simple, naked and short, tepals linear, ·12–·25″ long. Fem. umbel sub-similar, staminodes 3, ovary obtusely 3-gonous, stigmas short obtuse recurved.

2. S. macrophylla, *Roxb.* Syn. S. ovalifolia, *Roxb.*; Atkir, *K.*, *S.*; Raupawan, *Kharw.*; Muter, Rajdantni, *Or.*

A stout prickly climber with stems sometimes 1″ diam. below, flowering branches mostly unarmed. Leaves broadly elliptic, or orbicular, 6″ by 5″ to 12″ by 12″, sheath neither broadly winged nor auricled. Umbels 1–3, rarely 5, in axillary short cymes rarely 3″ long on peduncles shorter than the diameter of the umbel, with bracts at the nodes ovate or truncate.

Common in the damper forests. Champaran! Purneah! Chota Nagpur, all districts! Santal Parg.! Mayurbhanj! Sambalpur! Fl. April–July. Fr. Nov.–Jan. Subdeciduous in May.

Prickles small. Branches quite terete or with 4 lines or angled, striate when dry. Leaves with a short hard cusp, base rounded or subcordate, but sometimes suddenly acute and decurrent on the petiole, usually 7-costate, sometimes even 9-costate in the larger leaves, 3 ribs often produced on to the petiole, sometimes 1–2 adnate to midrib for ·5–·7″ above the base. Base of petiole sheathing, triangular in section, enclosing a hard bud or base of the inflorescence, sheath not broadly winged, but its thin edges often infolded and meeting above at the base of the articulation of the petiole proper where the two cirrhi thus arise almost base to base. Peduncle of inflor. ·5–1″, proper peduncles of umbels ·5–1·5″ in

male, ·5–·75″ in female, large basal bract at base of inflorescence exserted from the sheath. Pedicels ·25–·3″ or ·5 in fruit. Male sepals ·27″ long by ·06″ broad, oblong, rounded with thickened tips, petals about ·25″ narrower and thicker. St. slightly longer than sepals, anthers ·07–·08″ linear-oblong. Berry globose ·3–·5″ diam., 1–3-seeded, seeds biconvex.

A preparation of the root is applied for rheumatism and pains in the lower extremities, *Camp.*

S. zeylanica, *L.*

I cannot distinguish this from *macrophylla* except by the branches being more or less 4-angled and its smaller leaves, both unsatisfactory characters as the branches of *macrophylla* have sometimes raised lines or several angles. The upper leaves of *macrophylla* appear often to be like those of *zeylanica.* If the two are identical, they will, however, all have to be called *zeylanica.* A specimen from Sirguja, *Wood,* is named *zeylanica* in the *Calcutta Herbarium.*

3. **S. Roxburghiana,** *Wall.*

Branches terete, branchlets 4-angled unarmed. Leaves elliptic ovate or ovate-lanceolate, obtusely acuminate without a hard cusp, 5–8″. Sheaths with large auricles. Panicles with 1–3 very unequally peduncled umbels on a common peduncle 1–3″ long. Berry ·3″, seeds 1–2 biconvex reddish.

Parasnath! Santal Parg.! Fr. May.

I have only seen fruiting specimens in the field. The proper peduncles vary from ·12″–·2″ on the same plant. The type looks like *prolifera* with few umbels. The Parasnath specimen has large prickles on the branches, ovate-lanceolate to lanceolate leaves, larger 7″ by 3·7″ with finely reticulate nervation. M. peduncles slender, fl. buds ·2″. I think further study in the field will reduce it to a form of *prolifera.*

4. **S. prolifera,** *Roxb.* Same vern. names.

A stout prickly climber with stems up to 1″ diam., branches mostly terete, armed throughout. Leaves narrowly elliptic, ovate-oblong or more rarely broadly elliptic, attaining 8″ by 6″, usually 5″ by 2·5″ to 7″ by 4″, sheaths with large incurved wings with auricles often amplexicaul at base, apex often auricled laterally compressed and forming a rounded keeled tip above the petiole, from the junction of which and the petiole arise the two long cirrhi. Umbels in axillary and terminal panicles 3–6″ long usually whorled 3- (1–4-) nate, slender proper peduncles about 1″ long, bracts at the nodes small acute up to ·12″ long (in very compound panicles the main branches are supported by leaf-sheaths without petiole or blade).

More frequent than *S. macrophylla* especially in dryer localities, but it also prefers the sides of streams, ravines, etc. Champaran, Ramnagar Hills! Purneah, more common than *macrophylla*! Chota Nagpur, all districts, frequent especially in the hills! Mayurbhanj! Fl. Feb.–April. Fr. Nov.–Dec.

Branches sometimes somewhat angled, prickles under ·12″. Leaves with a short hard cusp, base rounded subacute or subcordate, 5-costate, of which the two stronger lateral costæ are connate with midrib to about ·3″ above the base, the next outer from the base weaker, and there is sometimes another slender nerve proceeding above the base close to the margin each side. The large sheaths on older leaves are sometimes 2·5″ long with the sides inrolled to form a closed chamber, finally hardened. Petiole above the sheath ·5–·8″ long, stout. Peduncle of inflorescence 1–2″, male proper peduncles slender 1–1·5″ fem. ·75–1·25″; pedicels ·25–·3″ or fruiting ·5″, perianth recurved. Male sepals ·17″ long, linear-oblong with rounded tip, pet. linear, as long; st. about as long, anthers white linear, ·06″. Fem. sep. stouter lanceolate from a rather broad base (·05″ wide). Pet. with an ovate-lanc. base, staminodes filiform. Ovary ellipsoid, ovules 1 in each cell,

narrow-oblong. Berry ovoid, red to black, ·3–·4″ long, or subglobose. Seed usually 1, rarely 3, pale yellow, shining, rounded with a dark basal umbo.
(One specimen had sepals and petals nearly as large as in *macrophylla*).

2. ASPARAGUS, *L.*

Shrubs or undershrubs, erect or often scandent, rarely herbaceous, with stout creeping rootstock. Leaves reduced to minute scales, often spinescent, bearing in their axils tufts of more or less leaf-like acicular, flattened or 3-quetrous barren branchlets (cladodes). Flowers small or minute, axillary, rarely 1-sexual, solitary fasicled or racemed, on jointed pedicels. Perianth 6-partite white or greenish. Stamens on the bases of the segments. Anthers oblong. Ovary 3-gonous with style and 3 stigmas, cells 2–more-ovuled. Berry globose. Seeds 2–6 with black brittle testa; embryo dorsal.

A. Leaves becoming spines below. Fls. distinctly racemed :—
Cladodes slender ·5–1″, often falcate, shorter than the racemes . . . . . 1. *racemosus.*
Cladodes stout 1–2·5″, striaght, exceeding the racemes . . 2. *acerosus.*
B. Leaves spurred but not spinescent. Cladodes ·25–·4″ long.
Fls. solitary, 2–3-nate or laxly racemed. Erect . . . 3. *gracilis.*

1. **A. racemosus,** *Willd.* Huring Atkir, *K.*; Kedar nari, *S.*; Sata-war (the roots), *Th.*; Gaichera, *Or.*; Isparjar (Sambalpur).

A slender scrambling or scandent suffruticose perennial with woody prickly shoots with reflexed spines. Cladodes more or less acicular and 3-quetrous, falcate, ·5–1″ long, divaricate, finely acuminate. Flowers white, sweet-scented, ·12″ diam. on filiform articulate pedicels ·12–·17″ long in very short racemes, or some racemes compound and up to 3·5″ long. Berries ·1–·25″ diam., scarlet.

Common in the forests and scrub jungles. Champaran! Santal Parg.! Chota Nagpur, all districts! Puri! Mayurbhanj! Sambalpur! *i. e.* throughout the whole province. Fl. Sept.–Dec. Deciduous, or dying back to the root in the h.s.

The plant is rather variable. The following forms occur in our area :—

Var. *α.* **Prainii.**

This is a very distinct plant from the ordinary *racemosus* in its very short cladodes. Stems with strong straight reflexed thorns ·3″ long below. Branches spreading striate, 3-quetrous or not. Cladodes only ·3–·4″ rarely ·5″, and only 2–3-nate, rarely 2- or 4-nate divaricate, 3-grooved or unequally 3-quetrous, tip with a minute white spinulose point, and angles minutely scabrid. Racemes usually very short, often with rhachis under ·2″ and few-fld., but sometimes they are 1–1·5″, which connects the variety with the ordinary form, bracts about half as long as the pedicels. Berries ·17–·25″ diam. Seed usually only 1, black, somewhat ellipsoid-globose.
The common form in Singbhum forests. *Prain* (to whom it was sent in 1902) remarked that it was a very puzzling form.
Roxburgh draws a distinction in the position of the embryo in *racemosus* and *acerosus*. As far as I follow him the embryo of var. *Prainii* is that of his *acerosus*; the radicle starts in the umbilical hemisphere low down, and the filiform embryo ascends in a large semicircle remote from the umbilicus and down again to the equator the other side. The arch, however, is not in one plane but wavy.

Var. *β.* (near *racemosus* proper).

Branches sharply angled. Cladodes 1″, 4–8-nate, very falcate. Racemes long and branched often 2″–3·5″ and sometimes bearing spines and flowering when

leafless. Bracts as long as the ·07–·09″ pedicels (they are much shorter in ordinary *racemosus*). *Puri* !

I find that the seedling from the very commencement only shows scale-leaves and cladodes. There are no normal leaves.

A decoction of the root is used medicinally by the Tharus and also given in fever by the Santals.

2. A. acerosus, *Roxb.*

A slender scrambling or scandent suffruticose perennial similar to *A. racemosus* but with very much stronger cladodes often 2·5″ long, 3–6-nate, triquetrous, acuminate, many times longer than the slightly recurved spines. Racemes shorter than the cladodes, 1–1·5″, bracts lanceolate concave. Flowers pure white, fragrant.

Karagolah ghat, Purneah, *Clarke* ! Fl. May. Also in the Duars.

It appears to pass into states of *racemosus*.

3. A. gracilis, *Royle.*

An erect very graceful plant about 4 ft. high with feathery branches and small white star-like flowers ·2″ diam. in lax racemes. Cladodes straight terete acicular in clusters of 6–9, ·25–·4″ long.

Forests near Neterhat. Elev. 2500–3000 ft. New shoots and flowers in May. Fr. Oct.–Nov.

Stems and branches terete polished. Bract leaves scarious. The blade ·05–0·7″, acuminate, somewhat hastate at base and with a spur as long as the blade; spur somewhat hardened but never developing as a spine. Bracts and bracteoles at base of pedicels similar. Flowers distant solitary and scattered along, or sometimes 2–3-nate on the top of, special flowering branches (racemes) 1–2·5″ long, which sometimes terminate ordinary leafy shoots or are lateral and bare except for the bracts. Pedicels ·1–·15″ jointed near the base. Tepals ·1″ oblong with rounded tip. Fil. ·07″ subulate flattened membranous. Fruit subsolitary red ·2″ diam.

3. DRACÆNA, *L.*

Shrubs or trees with alternate or crowded and subterminal, sessile or petioled leaves, either with strong costæ or many fine parallel nerves. Flowers rather small for the size of the plants, in terminal racemes, panicles or heads with small bracts. Perianth tubular, campanulate or funnel-shaped, 6-cleft, lobes narrow. Stamens 6, inserted at the base of the tube, filaments filiform or flattened, anthers versatile. Ovary 3-celled with filiform style and capitate stigma. Ovule 1 in each cell, erect. Fruit baccate, globose didymous or 3-lobed. Seeds globose or angled, testa thickish, albumen horny. Embryo small.

A number of beautiful species of *Dracæna* are cultivated in Indian gardens and in verandahs. They have mostly more or less lanceolate or sword-shaped leaves which are often brilliantly coloured, especially at the back. They are usually known as Dragon-plants.

The following are wild species :

L. elliptic or ell.-lanceolate, 5–10″. Raceme simple . . . 1. *terniflora.*
L. linear or ensiform, 8–20″. Panicle large . . . . 2. *angustifolia.*

1. D. terniflora, *Roxb.*

Shrubby 2–4 ft. high with elliptic or elliptic-lanceolate very broadly petioled leaves 6″ by 2″ to 10″ by 3″ or (in the Augul plant) more

slenderly petioled and only 1·5″ wide, tip finely but shortly acuminate, base passing imperceptibly into the petiole. Flowers 2–3-nate shortly pedicelled in the axils of small bracts of a simple cernuous raceme 3–4″ long or about 6″ in fruit. Perianth very slender, ·7–·8″ long, greenish-white, sometimes curved, segments linear valvate, free two-thirds or more of the way down, very obtuse, twisted soon after opening. Fruit red, ·35–·6″ diam., globose didymous or sub-3-lobed according to the number of seeds.

Under rather dense shade. Puri! A similar-looking plant but with narrower leaves (see above) and neither in flower nor fruit has been sent to me by *Mr. Chattarjee* from Angul! Fl. May–June. Fr. Sept.–Oct. Evergreen.

Stems ringed at the nodes, thickened and nodose at the rootstock. There are remarkable lanceolate leaf-sheaths or bracts clothing the stems between groups of leaves, possibly the beginning of each year's growth; they are mostly finally deciduous, but some appear to grow up into small leaves. L. with numerous parallel nerves. The petioles are very variable from slender and ·06″ wide to stout and ·2″ wide; length varies from 1–3″.

2. **D. angustifolia,** *Roxb.*

An erect shrub 4–10 ft. high with cylindrical stems ·5–·75″ diam. Leaves ensiform or linear, 8″ to over 2 ft. long by ·75–2″ broad, sessile on the sheathing base. Flowers white 2–3-nate on the branches of a large decurved spreading panicle. Perianth ·75″ long, lobes ·5″ linear, spreading and reflexed.

Shady banks and edges of streams in the Duars!, and possibly extends westwards into Purneah. Fl. Nov.–Dec.

4. SANSEVIERIA, *Thurle.*

Stout often fleshy herbs with a short often stoloniferous rootstock or creeping rhizome. Leaves narrow, cartilaginous or fleshy, flat or terete, nerves immersed. Flowers racemose on a stout scape, white or greenish. Perianth more or less slenderly tubular with narrow erect, spreading or revolute lobes. Stamens 6 inserted opposite the tepals with slender filaments and dorsifixed anthers. Ovary superior, attached by a broad base, 3-celled with filiform style and simple stigma. Ovules solitary erect or ascending from the lower angle in each cell. Fruit membranous indehiscent with 1–3 large globose fleshy seeds appearing like 3 fleshy carpels, the membranous pericarp evanescent.

Several species, including *S. Roxburghiana*, are cultivated as garden plants in our area and known as *Sword and Bayonet plants*. The genus affords a valuable fibre known as *Bowstring Hemp*, which is usually said to be derived from *S. guinensis*. A revision of the whole genus is given by *N. E. Brown* in the *Kew Bulletin* for 1915. From this it appears that *S. guinensis, Baker*, etc., is *S. metallica, Gér. & Labr.*; *S. g. Gér. & Labr.* is *S. trifasciata, Prain*, which is closely allied; *S. g. Hort* is *S. cylindrica, Bojer*; *S. g. Willd.* is *S. thyrsiflora, Thunb.*; *S. guinensis, Schwein*, is *S. abyssinica, N. E. Br.*? etc., and it is not known which of these species yields the best quality fibre.

1. **S. Roxburghiana,** *Schult.* Murba, *Beng.*; Murga, *Or.*

An erect fleshy plant with tufted leaves 12–18″ high by 1–1·3″ broad, linear-oblong, flat but convex on lower surface, not semi-terete,* the young only concave on upper surface, widest about the middle, clouded with irregular bars of darker green on both surfaces, tip ending in a solid cusp 1″ long. Raceme strict dense, shorter than

* The Angul plant had semi-terete leaves 2 ft. long and was not in flower.

the leaves, about 12″ by 2″ including the 4″ long peduncle, flowers in clusters of 2–3 on small tubercles and with as many scarious bracts, suberect. Perianth ·6–·7″ long and same distance across at the mouth, tubular with finally revolute lobes free over half-way down, lobes linear obcuneate with obtuse somewhat inflexed thickened papillosely pubescent tips.

Gregarious as an undergrowth on rocky soils under shade in the Kahuri, Baruni Hill, Selingpara and other forests in Puri division! Steep slopes along shady ravines, Angul!* Fl. June–July. Fr. Dec.

Rhizome horizontal creeping sending up tufts of leaves at intervals. Pedicels jointed, ·1–·3″ tinged violet, broader above the joint. St. somewhat shorter than tepals, anthers oblong, lobes distinct at base up to the filament. Ovary broadly oblong, somewhat 3-grooved, with style ·6″ long and exserted capitellate stigma. The scape is sheathed with about 3 linear-lanceolate concave pale bracts with solid tips.

Flowers each last a day, lobes erect up to 3 p.m., then spread and become revolute about 4 p.m., when the anthers become far exserted. The plant yields a very good fibre used for bowstrings, etc.

5. CORDYLINE, *Commers.*

Characters of *Dracæna*, but ovules 4–16 in each cell of the ovary, testa black shining. Embryo nearly as long as the albumen.

1. **C. terminalis,** *Kunth.* (Often called a *Dracæna* by horticulturists.)

A moderate-sized shrub with long oblong-lanceolate or linear-lanceolate distichous green or purplish leaves 1–3 ft. long by 2–3″ broad with broad petioles. Flowers white or purplish or rose-coloured, small, pretty, ·3″ long, 3-nate and sub-sessile on the branches of a large erect simply branched panicle 1–2 ft. high.

Widely cultivated and very ornamental. Fl. March. There are several varieties in cultivation, some with coloured or variegated leaves, not distinguishable from *Dracæna* without the flowers or fruit.

6. YUCCA, *L.*

Handsome stout shrubs or trees with simple or branched stems and terminal clusters of large linear-lanceolate or ensiform coriaceous or fleshy thorn-tipped leaves. Flowers large drooping campanulate in a many-fld. terminal panicle of racemes. Perianth segments free or nearly so. Stamens much shorter than corolla with thickened filaments and small sagittate anthers. Ovary-cells many-ovuled, incompletely 2-locellate. Fruit capsular or baccate.

Natives of the United States and Central America. The two following are commonly cultivated in gardens and known as Adam's Needle or Spanish Bayonet. They are very ornamental both in foliage and flowers.

1. **Y. aloefolia,** *L.*

Often attains 15 ft. in height with generally a simple stem and a crown of narrow sword-shaped grey-green finely toothed leaves. Flowers usually white in a large dense panicle 1–1½ ft. long. Fruit baccate.

2. **Y. gloriosa,** *L.*

Woody stem rarely exceeding 3 ft. Leaves more broadly ensiform.

* The Angul plant had semi-terete leaves 2′ long and was not in flower.

Panicle much larger, up to 3–6 ft. in length with larger bell-shaped white flowers. Frt. dry but not dehiscent.

7. ALOE, *L.*

Dwarf fleshy leaved plants, more rarely arboreous. Leaves forming rosettes or 2-ranked, usually spinosely dentate. Flowers in terminal simple or branched racemes, usually reddish-yellow with green; perianth segments united into a cylindric or campanulate straight or slightly curved tube, tips sometimes free. Stamens as long as perianth or longer, filaments inserted into a pit in the connective. Frt. loculicidal.

The Aloes are especially abundant in South Africa. The most widely spread species is probably **A. vera**, *L.*, which, originally from North Africa, has been introduced into most warm countries. It is probably the plant alluded to by *Firminger* under the name of *A. indica*, "a common plant throughout the country with leaves thorn-edged, thick, soft, pale-green and bearing dull red flowers." The spike is simple erect elongating, the lower flowers usually falling off as it lengthens.

The plants usually called Aloe are species of *Agave*.

Hemerocallis fulva, *L.* The Day Lily.

A robust plant with a very short rhizome and numerous fleshy roots. Leaves 1–3 ft. long, linear. Flowers large erect tawny-yellow in a few-fld. panicle at the top of a leafless scape. Perianth funnel-shaped with a short cylindric tube and many-nerved erecto-patent tepals. Stamens at the top of the tube, declinate, shorter than the perianth, with dorsifixed anthers, the filament inserted into a pit. Ovules many. Capsule coriaceous 3-quetrous.

Common in gardens and verandahs.

8. DIANELLA, *Lamk.*

Herbs, stout in our species, with usually branched stoloniferous rootstock and rigid, distichous, linear, often equitant leaves. Flowers in cymose panicles, nodding, jointed on their pedicels. Perianth marcescent, segments distinct spreading. Stamens 6 hypogynous, or 3 inner on the bases of the petals, filaments much thickened; anthers basifixed, reflexed, opening by terminal pores or short slits. Ovary 3-celled with filiform style and minute stigma. Ovules 4–8 in each cell. Fruit baccate. Seeds few ovoid or compressed with shining black testa and fleshy albumen.

1. D. ensifolia, *Red.*

A stout herb 18″–3 ft. high with equitant linear distichous leaves strongly laterally compressed at the base and 18″–3 ft. long. From the centre of the leaves rises one or more slender scapes terminating in a panicle of umbelliform racemes of greenish or white flowers developing in fruit beautiful cobalt-blue berries ·3–·4″ diam.

Rocky ravines, *pâts* of Ranchi and Palamau (Neterhat. 3000 ft.)! Fl., Fr. April–June.

Rootstock stout creeping. L. narrow below, sharply keeled by the midrib, flat above and sharply acuminate, ·8–1·2″ wide in middle, midrib beneath and margins scabrid. Scape somewhat compressed and angled with sharply keeled

foliaceous bracts, panicle narrow, 3-10″ long, with suberect branches, lower longest bearing one or more short close racemes of nodding flowers with oblong tepals ·25–·3″ long, chiefly remarkable for their stamens, the top of each filament being suddenly expanded and of an orange or yellow colour as is the ·12″-long anther. Pedicels ·3–·5″ jointed under the flower. Berry 3-celled with 1-2 oblong-ovoid black shining compressed seeds ·17″ long in each cell.

The flowers open in the evening and close the following morning.

9. DISPORUM, *Salisb.*

Erect, sometimes almost suffruticose, herbs with creeping rootstock and angular leafy often 2-chotomously branched stems. Leaves sessile or sub-sessile rather strongly nerved. Flowers in terminal or axillary few-fld. umbels with decurved pedicels. Perianth campanulate, deciduous, with 6 erect segments, base saccate or spurred. Stamens 6, hypogynous, with dorsifixed extrorse anthers. Ovary 3-celled with long or short style and 3 short stigmas. Ovules 2–6 in each cell. Fruit a pisiform black fleshy berry. Seeds few, subglobose with appressed testa, brown.

1. D. pullum, *Salisb.*

A stout herb 3–4 ft. high dichotomously branched above, stem ·3″ diam. below. Leaves alternate and opposite ovate-lanceolate 3–5″ by 1–1·6″, acute or acuminate, stronger nerves about 6–8, petiole very short decurrent as a raised line on the stem. Flowers about 5–6 in a short-peduncled deflexed umbel on angled or fluted decurved 1–1·5″-long pedicels which are very scabrid on the angles. Fruit black depressed sub-trigonously globose, ·3″ diam., with 1 seed only in each cell.

Shady banks and along nalas usually over 1000 ft. elev. Forests of Singbhum, chiefly Porahat! Ranchi, Neterhat, 3000 ft.! Parasnath, 3000 ft.! Fl. r.s. Fr. Oct.–Dec.

I have not seen the fresh perianth, the plant being always in fruit when I have met with it. It is ·7–·8″ long, and described as white or dull purple with spathulate or lanceolate acute or acuminate segments which are saccate or subsaccate at the base. The seeds are light brown, orbicular-oblong, ·2″ long.

10. GLORIOSA, *L.*

Stems from a tuberous naked rootstock, leafy, scrambling or climbing by the cirrhose leaf-tips. Leaves alternate, opposite or 3-nately whorled, lanceolate, with prominent midrib and elongate spiral tip. Flowers large, axillary, solitary and subcorymbose, slightly irregular. Perianth persistent, tepals 6 subequal, narrow, spreading or reflexed, often waved or crisped. Stamens 6, hypogynous with filiform filaments and linear dorsifixed versatile extrorse anthers. Ovary 3-celled with slender style sharply bent upwards, dividing at tip into 3 filiform or subulate introrsely stigmatose lobes. Ovules many. Fruit a large coriaceous septicidal capsule. Seeds subglobose with spongy testa and cylindric embryo.

1. **G. superba,** *L.* Bunum-ki-chung, Bing-ki-chung, *K.*; Jagara, *M.*; Sinic' samansom, *S.*; Karihari, *Kharw.*; Kariari-bishalanguri, *Beng.*

A beautiful and well-known plant 3–10 ft. high, scrambling among

other bushes and supporting itself by the sessile or subsessile leaves, which are 5–6″ long excluding the circinate tip. Flowers inverted, tepals 2–3″ long by ·4–·6″ broad, beautifully waved and crisped, lower half yellow, upper half red, finally the whole turning more or less red, often subcorymbose at the ends of the branches.

Hedges and low jungles. Central and southern areas, common! Fl., Fr. r.s. The aërial shoots are annual and die down completely by the end of the cold season.

Rootstock large torulose. Leaves finely parallel-nerved each side of midrib, base rounded. Peduncles often 7″ long.

The roots give one of the seven minor poisons of Sanscrit writers, and *Dutt* gives *langulika* as well as *kulikari* as Sanscrit names. It is used in Hindu medicine and is also said to yield a violent poison with which the Kols used to tip their arrows. Many Kols, however, profess not to have heard of this, and also state that the root is sometimes eaten after preparation.

Agapanthus umbellatus, *L'Her.* The Blue African Lily.

A very beautiful plant with tough branched rhizomes and numerous fleshy roots. Leaves linear, rather thick, basal and shortly distichous. Flowers with short cylindrical tube and longer suberect oblanceolate segments, blue (a white variety also occurs). Stamens filiform adnate to the tube. Ovary cells with many ovules. Seeds numerous black flattened imbricate in the almost 3-lobed capsule.

Frequently cultivated in verandahs, especially on the plateaux. Native of South Africa.

11. ALLIUM, *L.*

Usually pungently fœtid (alliaceous) herbs with tunicate bulbs. Leaves radical and scapose, mostly narrow, terete fistular flat or grooved. Flowers capitate or umbelled, sheathed by 1–2 membranous spathes, sometimes replaced by bulbils. Perianth leaves 6, free, spreading or campanulate. Stamens 6, hypogynous or at the base of the tepals, or perigynous; filaments free or connate below, anthers oblong. Ovary 3-gonous, style filiform simple or 3-cleft with simple stigmas. Ovules few in each cell. Fruit a membranous 3-lobed capsule, with usually depressed top, loculicidal. Seeds 1–2 at the base of each cell, turgid or compressed, black. Embryo curved, excentric, radicle next the hilum.

All the following species are cultivated only in our province.

I. Bulbs not seated on a rhizome :—
  A. Leaves flat, sometimes keeled. Filaments of inner whorl 3-cuspidate, the central cusp anther-bearing :—
    Head with many bulbils. Fls. white . . . 1. *sativum.*
    Head without bulbils. Fls. red or greenish-white . 2. *ampeloprasum.*
  B. Leaves fistular, terete or semi-terete. Filaments not cuspidate, but those of inner whorl sometimes with a tooth each side of the broad base :—
    St. included. Perianth red . . . . . 3. *schœnoprasum.*
    St. about as long as perianth. Fls. white or lilac . 4. *ascalonicum.*
    St. longer than perianth. Fls. greenish-white . . 5. *cepa.*
II. Bulbs elongate seated on a creeping rhizome. L. flat :—
    St. shorter than perianth, perigynous . . . 6. *tuberosum.*

1. **A. sativum,** *L.* Lasuni, beluli, *Vern.*; Garlic.

Bulb with membranous outer scales in the axils of which are 10–12 lesser bulbs (*cloves* of gardeners). Leaves flat, linear, with sheaths

about half their length. Scape slender. Heads subglobose with a long beaked involucre deciduous in one piece, and with numerous bulbils. Fls. white, sepals lanceolate acuminate, inner filaments 3-toothed at apex, centre tooth with anther.

Widely cultivated by the natives of India, not often by Europeans. The crop is taken up at the commencement of the h.s., and the "cloves" after being dried stored away for use.

2. **A. ampeloprasum,** *L.* Syn. A. porrum, *L.*; The Leek.

Bulbs cylindric. Scape with flat leaves 2–3 ft. high. Head almost globose with very long-beaked spathe, without bulbils. The wild plant (Mediterranean region) has reddish flowers. The commonly cultivated (var. *porrum*) variety is distinguished by the almost complete absence of subsidiary bulbs in the axils of the bulb scales and the whitish or greenish flowers. It is cultivated chiefly in European gardens in the c.s.

3. **A. schœnoprasum,** *L.* Chives.

Bulbs weakly developed. The thin awl-shaped onion-flavoured leaves are the parts eaten. Heads globose. Perianth red. St. included with subulate anthers. Rarely cultivated.

4. **A. ascalonicum,** *L.* Gundham, *Vern.*; Shallot.

Bulbs ovate-oblong fascicled, outer skin brown-yellow. Leaves subulate fistular but compressed towards apex. Scape slightly swollen below. Spathes shorter than umbel with 2–3 irregular subovate segments. Fls. white or lilac but rarely flowering in cultivation. Anthers ovate, green (*Roxb.*).

Much cultivated in Indian gardens in the c.s.

5. **A. cepa,** *L.* Piyaj, *Vern.*; Onion.

Leaves subdistichous fistular. Head often with bulbils, pedicels shorter than the stellate greenish-white flowers; stamens exserted, inner often 2-toothed at the base.

Largely cultivated in both Indian and European gardens.

6. **A. tuberosum,** *Roxb.* *Vern.* Banga-gandina (*fide Roxb.*).

Bulbs cylindric with white fleshy root-fibres on a rhizome. Leaves narrow-linear compressed or 3-gonous. Head 1–1·5″ diam. lax-fld. Pedicels much longer than the small white or pink stellate fls. Fil. simple linear included, connate below and perigynous.

Roxburgh says he finds it cultivated about Calcutta. It will therefore be very probably cultivated in Orissa.

12. URGINEA, *Steinh.*

Bulbous scapigerous herbs, scape naked, flowers sometimes appearing before the leaves, racemed, white, green or brownish; bracts small. Perianth campanulate or widely stellately spreading, of 6 subequal segments. Stamens shorter than the perianth, inserted at the base of the segments; anthers versatile set on filament close to its base

between the lobes. Capsule oblong, 3-quetrous, loculicidal, many-seeded. Seeds flat, uneven, with black membranous testa.

All the Floras give " perianth campanulate " as a chief generic character, having failed to note that some of the species at least are night-flowering, and that at night the perianth is widely spreading.

1. U. indica, *Kunth.* Kandri, *H.*; Indian Squill.

Scape 1–2·5 ft. high, appearing long before the leaves, slender and very lax flowered. Flowers usually only about 4–8 on the scape on very long pedicels which are erect and about ·75″ long before flower expands, and then elongate to 1·5″ or even 2·5″ in fruit and become recurved and then finally erect again. Perianth rotate when open, campanulate ·3–·4″ long before and after opening, segments greenish with a brown streak outside, white within, narrowly oblong, sometimes pubescent at the tip. Ovary oblong 6-grooved with short stout style and 3-gonous stigma. Capsule ·4–·7″, narrowly ovoid-oblong, coriaceous, 3-quetrous, each carpel ribbed in centre and on the margins.

Frequent, often seen on fire lines in the forest and on grassy plateaux. Singbhum! Ranchi! Palamau! Near nalas, Gangpur! Angul! Mayurbhanj! Kalahandi, *Cooper*! Probably therefore in all districts of the central and southern areas. Fl. March–May. Fr. May–July. L. appear June. Each flower only lasts one night, opening in the evening and closing early in the morning.

Bulbs globose-ovoid 1·25–1·5″ diam. with a neck 1″ or more long, tunicate with adhering grey fleshy scales without any smell. L. linear 6–18″ by ·5–1″, flat, acute. Bracts subtending the pedicels of the buds ·08″, ovate-lanceolate auricled, soon withering. Seeds ·3″ including the wing, irregularly orbicular.

The bulb is said to have the properties of *Scilla indica* and *Urginea scilla* (see under *S. indica*). It is also used for sizing cloth.

13. SCILLA, *L.*

Herbs with tunicate bulbs and radical usually narrow leaves. Flowers racemed on a leafless scape with small bracts. Perianth campanulate or stellately spreading, marcescent, with 6 subequal often recurved segments. Stamens 6, inserted at or near the base of the perianth segments with usually filiform filaments and ovate or oblong anthers introrsely dehiscent. Ovary 3-celled with filiform style and small capitate stigma. Ovule 2–few in each cell. Fruit a globose 3-lobed loculicidal capsule with cells 1–2-seeded. Seeds obovoid or subglobose with thin black testa. Embryo shorter than the firm albumen.

1. S. indica, *Baker.* Indian Squill.

Rather a pretty small bulbous herb, especially when the leaves which are coætaneous with the flowers are blotched with deep black. Scapes 4–7″ high, very many-flowered. Fls. greenish-purple with purple filaments. Per. segments linear-oblong, ·15–·25″ long, campanulate below then spreading, erect in fruit. Capsules membranous ·17″ long and broad.

Although common locally in the Central Provinces it is rare in our area.

Manbhum, *Camp.*! Fl. June–July. It usually grows in grass areas and produces leaves and flowers after the grass is burnt.

Bulb globose or ovoid, 1–1·5″ diam. L. 3–6″ by ·5–1″, oblong, lanceolate or

oblanceolate, rather fleshy, wavy, uniformly green or variegated with black, sometimes bulbiferous at the ends where they touch the ground. Scape stout with minute bracts. Pedicels ·25–·3″ long, filiform. Ovary tridymous with each lobe didymous, stipitate.

It is used in medicine as a stimulant, expectorant and diuretic. The squill of the English *Pharmacopœia* is *Urginea scilla, Steinh.*, from the Mediterranean coasts, but *Urginea indica* was also made official in 1914. *Scilla indica* and *Urginea indica* are probably mixed up in the bazars, but the bulb of *Urginea* has a longer neck.

14. IPHIGENIA, *Kunth.*

Herbs with erect leafy stems rising from a coated corm. Leaves few, cauline, linear, upper bractiform. Flowers small erect solitary or corymbose. Perianth 6-partite, stellately spreading, deciduous with equal narrow-clawed segments. Stamens 6, hypogynous with short flat filaments and versatile, oblong introrsely attached anthers. Ovary sessile, 3-celled with minute styles connate at the base, linear recurved, introrsely stigmatose. Ovules many in each cell. Capsule loculicidal. Seeds subglobose ; testa thin, appressed, brown.

1. I. indica, *Kunth.* Chutia chandbol, *S.*

Erect 6–12″ high with rather flexuous leafy stems. Leaves almost grass-like 3–8″ by ·17–·3″. Flowers purplish, 1–3 on axillary and terminal bracteate peduncles, bracts like the leaves but small. Capsule oblong ·5–·8″ long (only ·25″ according to *F.B.I.*), valves rounded, depressed along the median line and somewhat beaded opposite the seeds.

Ramnagar Hills, on gravel ! Manbhum, *Camp.* ! Fl. r.s. Fr. Oct.–Nov.

Corm globose, ·5″ diam. with a neck 1–2″ long and covered with brown sheaths. Perianth ·25–·3″ long with linear-subulate segments spreading and reflexed. Pedicels ·5–2″ long. Seeds about 16 in each cell in the larger capsules, subglobose, sometimes somewhat angled, ·07″ diam., falling with part of the placenta attached.

The flowers are said to yield a red dye.

15. ASPHODELUS, *L.*

Annual or perennial herbs with slender or fleshy root-fibres. Leaves all radical, linear, triquetrous or terete and fistular. Flowers white, racemose, solitary in the bracts, perianth marcescent, 6-partite, segments conniving into a tube below. Stamens 6, hypogynous ; filaments dilated at the base and embracing the ovary, anthers versatile with a pit on the back into which the filament is inserted. Ovary 3-celled with filiform style and sub-3-lobed stigma. Ovules 2 collateral in each cell. Capsule usually 1-seeded, loculicidal. Seeds 3-quetrous, testa black appressed. Embryo nearly as long as the cartilaginous albumen.

1. A. tenuifolius, *Cavan.* Syn. A. clavatus, *Roxb.*

A rather weedy-looking annual with slender erect semi-terete fistular leaves 6–12″ long by under ·1″ wide, and one or several erect terete often much fastigiately branched scapes sometimes 3 ft. high, bearing white rather scattered erect flowers about ·25″ long on clavate pedicels

jointed below the middle. Bracts scarious, ·1″ long. Perianth segments with a brownish costa, filaments fusiform-tipped. Capsule globose, ·15–·17″ diam. with deeply transversely wrinkled valves. Seeds 3-gonous, with 3–4 dorsal ridges and as many lateral pits.

In cultivated fields, Singbhum! Behar, 1000 ft. *J.D.H.*! Common in cornfields in the United Provinces and extending into Bengal. Fl., Fr. May–June.

16. CHLOROPHYTUM, *Ker.*

Herbs with a short rhizome and often fascicled fleshy or tuberous roots, radical clustered often broad leaves, more rarely loriform or linear, and leafless simple or branched scapes. Flowers white, pedicelled, usually several in the axils of the bracts, densely or laxly racemed, sometimes sub-panicled. Bracts small or large. Perianth marcescent, not twisted, sometimes finally deciduous from the fruit, segments distinct, rotate 3–7-nerved. Stamens 6, hypogynous or very shortly adnate to the base of the petals, shorter than the perianth with filiform filaments usually dilated above the middle; anthers linear or oblong, erect, inserted by their base or dorsally by a small pit in the connective, introrse. Ovary sessile, 3-quetrous, 3-celled with filiform style and small stigma. Ovules 4–many in each cell. Fruit a coriaceous or fleshy capsule, truncate 3-lobed and acutely angled, loculicidally dehiscent. Seeds broad, more or less compressed, not angled,* with black testa. Embryo rather shorter than the cartilaginous albumen, often incurved.

A. Leaves 1–2·5″ wide. Perianth white ·3–·6″ long:—
  Racemes continuous, often subpyramidal with short branches at base. Tepals oblong-lanceolate, mostly acute. Bracts far overtopping the buds . . . 1. *arundinaceum.*
  Racemes strict interrupted. Tepals elliptic rounded. Bracts mostly shorter than the buds . . . . 2. *tuberosum.*
B. Leaves linear under ·5″ wide. Perianth greenish-white under ·25″ long . . . . . 3. *laxum.*

1. C. arundinaceum, *Baker.* Jerenarak', *S.*; Bis-Kandri, *H.*

Rather a pretty herb when young with suberect lanceolate many-nerved leaves and erect dense-flowered racemes or contracted panicles of white star-like flowers ·7–·9″ diam., the tepals oblong-lanceolate and usually acute, anthers as long or longer than the filaments, straight, green to yellow. Bracts usually long and overtopping the shortly pedicelled buds.

Monghyr, *Ham.*! Very common in Sal forests in all districts of Chota Nagpur, ascending to the tops of the pats (3000 ft)! Fl. March–July. Fr. c.s.

Stems stout truncate at base, with many long fibres at the ends of which are thick cylindrical tubers 1–1·5″ long by ·5–·6″ diam. greyish-white within. L. at first short with very broad amplexicaul base, often up to 15″ by 2·5″ while plant is in flower; ultimately the growing base becomes narrower so that the leaf may become oblanceolate. Scape 6″ to 15″, also elongating with age, very dense-flowered, raceme sometimes with strict erect branches at base and flowers 2–several in the axils of the lanceolate-acuminate bracts. Lower bracts 1″ or more, or in some specimens short but 5-more-nerved, mostly green. Pedicels ·15–·2″ jointed

* *Hooker* says "rugose." They may be in some species, but this is perhaps from herbarium specimens. The seeds of our species are certainly not rugose when fresh.

in the middle. Tepals ·3–·4 rarely ·5″, sometimes narrowly oblong and obtuse. Fil. ·15–·2″. Style declinate.

Fruiting scape often 18″ long. Capsules 1–3 at each node, ·25–·3″ each way or ·4″ diam. retuse or truncate. Seeds 1–6 in each cell, ·1″ wide suborbicular compressed but somewhat cordate or retuse at the hilum with a small prominence in the recess, black, turgid, minutely tessellate or punctate, not at all rugose.

Opens in the morning and closes in the afternoon. This is the most common species in the hill forests of our area.

The flowers are eaten.

2. **C. tuberosum,** *Baker.* Syn. Anthericum tuberosum, *Roxb.*

A very pretty herb with broadly linear leaves and erect or nodding lax-flowered racemes 4–10″ long of pure white flowers 1–1·3″ diam., the tepals elliptic with rounded tips. Anthers yellow recurved usually shorter than their slender filaments. Bracts mostly shorter than the buds, which have slender pedicels.

Santal Parganas (Rajmahal Hills)! Open forest lands usually on the gneiss and below the laterite in the hills of Ranchi and Palamau! Fl. May–June. Fr. c.s.

A much more slender and graceful plant than the last and with larger and prettier flowers. Root-fibres soon swelling into long cylindrical tubers 2–5″ long, but only about ·3″ diameter. L. ·3–·6″ wide, widest a little above the base, and tapering to the acuminate tip, base sheathing. Panicle rarely with 1 or more slender upright branches. Fls. mostly in pairs ·3–·7″ apart and raceme 2–5″ long, often half expanded and reminding one of snowdrops. Bracts very slender, lowest attaining 1″ with broad scarious base faintly 3-nerved, convolute above and linear setaceous. Pedicels slender, ·5″ articulate above the middle. Tepals ·5–·6″ ell., ell.-oblong, or sometimes obovate. Fil. ·2″, slender, glabrous, anthers papillose. Capsule (unripe) as broad as long, cells 1-seeded.

It opens in the morning and continues more or less open until evening.

3. **C. laxum,** *Br.*

A small herb with distichous grass-like leaves and a very slender somewhat flexuose scape of small greenish-white flowers arranged in distant pairs in the axils of small membranous bracts.

In thin soil overlying rocks on the pats of Ranchi and Palamau! Fl. May–June.

Roots ending at the distance of several inches in small tubers. L. 2–6″ long linear acuminate slightly keeled, rather thin and shining, usually under ·5″ wide, Scape sometimes bifurcate and bracteate at the fork. Tepals scarcely ·2″ erect. Anthers green with yellow pollen, minute.

Opens only in bright sunshine and never seen widely expanded.

Anthericum variegatum, *Hort.* = **C. elatum,** *R. Br.*

An attractive small plant with a fascicle of fleshy roots and tufts of leaves 12–18″ long lined with green and white. Inflorescence an ample panicle of branched racemes with distant clusters of small white flowers. Perianth ·3–·5″. Common in verandahs and grass greenhouses. Native of S. Africa.

FAM. 146. HÆMODORACEÆ.

Perennial herbs, mostly growing under shade with usually radical, distichous, narrow leaves with parallel nerves. Flowers 2-sexual, regular, in scapose spikes, racemes or panicles. Perianth petaloid, persistent, segment free or more or less connate, 2-seriate, imbricate or induplicate-valvate. Stamens 6 inserted opposite the tepals, or 3 only inserted at the base of the *inner* tepals; anthers erect or

versatile, 2-celled, rarely opening by pores. Ovary inferior, half-inferior or superior, 3-celled; with short 3-partite or entire style or subsessile simple or 3-notched stigma. Ovules 1-many, axile, or with 1 ascending from the inner angle, anatropous or semianatropous. Fruit superior or inferior, capsular or indehiscent. Seeds various. Embryo small, partially enclosed in the fleshy albumen.

The family is an intermediate group with transitions from the Liliaceæ, in which family *Sanseviera* is here included (although it is placed in Hæmodoraceæ in the *Genera Plantarum*), to the Irideæ and Amaryllidaceæ in the genera with inferior ovary.

Peliosanthes with purple fls. and filaments connate in a ring closing the mouth of the perianth has been found by me under dense shade in the Duars, and will probably be found in Purneah and the Mals of Orissa.

FAM. 147. ROXBURGHIACEÆ.

(Stemonaceæ.)

Herbs with short creeping or tuberous rhizome, erect or climbing, with petioled alternate opposite or verticillate lanceolar or cordate 3–many costate leaves with parallel transverse sec. n. Flowers regular, 2-sexual, on axillary peduncles. Perianth superior or half-superior of 2 2-merous whorls, tepals sub-similar, free or more or less connate. Stamens 4, inserted opposite to and on the base of the tepals or sub-hypogynous, anthers dorsifixed. Carpels 2, forming a 1-celled free or half-inferior ovary. Ovules 2 or more, erect from the base or pendulous from the top of the cell, anatropous. Fruit (where known) a 2-valved capsule. Seeds oblong with coriaceous testa, funicle more or less hairy. Embryo nearly as long as the albumen with its radical not far from the hilum.

1. STEMONA, *Lour.*

Root tuberous. L. lanceolar or ovate 3–9-costate. Flowers solitary or few racemose, rather large. Stamens subhypogynous, filaments very short, more or less connate in a ring, with linear erect anthers, connective produced in a very long linear-lanceolate appendage. Ovary free, compressed, with small sessile pointed stigma. Ovules 2 or more erect. Capsule compressed, few-seeded. Seeds erect, ovoid or oblong, terete, grooved, beaked, with thick testa.

1. **S. tuberosa,** *Lour.* Syn. Roxburghia gloriosoides, *Jones.*

A twiner with somewhat the foliage of a *Dioscorea* except for the secondary venation. Leaves ovate, cordate, caudate or shortly caudate, 5″ by 3″ to 10·5″ by 5·8″, with 7–11 primary nerves from the base of which 3–5 reach the tip, arcuate, with very fine close parallel secondary nerves. Petiole 2–3″, somewhat thickened both ends. Flowers erect fœtid, greenish with many parallel purple nerves, campanulate, 1·3–2″ long, tepals lanceolate acuminate, ·2–·25″ broad below. St. very large erect with stout red filaments deeply grooved in front with crenulate margins, anthers linear, inner layer of the cells produced into a subulate point, pollen between waxy and floury. Capsule 1·5″, ovoid-oblong, 5–8-seeded.

Bengal, *J.D.H.* (without locality)! *Prain* (*Beng. Pl.*) records it from Orissa, probably on the strength of the Northen Circars locality, but there are no specimens from Orissa as now constituted. Fl. June.

FAM. 148. PONTEDERIACEÆ.

Aquatic herbs with erect or floating parallel-nerved leaves. Flowers 2-sexual, irregular in spikes or racemes from the uppermost leaf-sheath, with irregular sheathing bracts. Perianth unequally 6-partite, marcescent, blue or white. Stamens 1–6, inserted at the base of the perianth with erect or versatile anthers, one usually longer than the others. Ovary free, 3-celled, or 1-celled with 3 parietal placentæ, style slender, stigma sub-entire or lobed. Ovules 1–more on each placenta, anatropous. Fruit a membranous loculicidally 3-valved capsule. Seeds small with horny or floury albumen. Embryo cylindric.

Tepals nearly free	1. *Monocharia.*
Tepals forming a distinct tube below	2. *Eichornia.*

1. MONOCHARIA, *Presl.*

Marsh herbs with short or creeping rootstock. Leaves radical, and solitary at the top of the emerged stem or branches. Flowers racemose or subumbellate campanulate with segments nearly free. Stamens 6, one larger with the filament toothed on one side, anthers basifixed, slit terminal at length elongating. Ovary 3-celled, many-ovuled.

Rootstock creeping. L. sagittate or hastate many-nerved .	1. *hastata.*
Rootstock short. L. linear to ovate, few-nerved . . .	2. *vaginalis.*

1. **M. hastata,** *Solms.* Syn. M. hastæfolia, *Presl.*; Pontederia hastata, *L.*

A pretty marsh herb with the exserted leaf sagittate or hastate with the basal lobes often rounded, 6–7″ long, 4–6″ broad, acute or obtuse and many-nerved, petiole about half as long, its sheath dilated and embracing the short peduncle of the shortly racemed or subumbellate inflorescence. Flowers long-pedicelled bright blue, ·75–1″ diam., with one large blue stamen and 5 smaller yellow ones. Inflorescence reflexed after flowering and capsule enclosed in the persistent twisted perianth.

Slow streams and standing water, common! Probably in all districts. Fl. r.s. Perennial.

Rootstock creeping. Radical leaves on petioles 18–24″ long, broad and sheathing at the base. Scape below the inflorescence 9–18″. Pedicels ·7–1″. Larger sepal obovate, smaller oblong. Perianth according to *F.B.I.* violet-blue dotted with red (I have not seen it so coloured). Filament spurred. Capsule subglobose or oblong, ·25″ diam.

2. **M. vaginalis,** *Presl.*

A smaller and less pretty plant than the last with short rootstock and usually narrow leaves, linear or lanceolate, more rarely ovate or ovate-cordate, sheaths embracing the scape for a considerable distance

so that the stem sometimes appears leafy; blade 5-nerved only 2–4″ long by 1–2″ broad or in var. *plantaginea* linear to lanceolate, 2″ by ·2–·6″, narrow cordate or base entire. Flowers blue with short pedicels reflexed after flowering, 6–12 subspicate or var. *plantaginea* as few as 2–3. Pedicels ·75″ or less.

In ditches, rice-fields, etc.! Fl. r.s. Annual.
Rootstock very short, stem often flaccid with the leaves floating. Perianth and stamens much as in *hastata*. Capsule oblong.

2. EICHORNIA, *Kunth.*

Water plants rooting in mud and sometimes rhizomatous or free floating by means of the swollen vascular petioles. Flowers with a well-developed perianth-tube and somewhat irregular spreading limb or limb distinctly 2-lipped, segments 6. Stamens 6, declinate, irregularly inserted in the tube, upper included; anther oblong, dorsifixed near the base. Ovary sessile. Ovules very many in each cell. Capsule included in the marcescent perianth, ovoid, oblong or linear, very thin. Inflorescence sessile in the leaf-sheath or peduncled, simply racemose, rarely panicled.

An American and tropical African genus of which the following has become widely naturalized.

1. **E. crassipes,** *Solms.* Kajaropati, *Or.*; Water Hyacinth.

A very beautiful plant with sympodial rhizome creeping in mud and freely floating, the termination of each joint of the sympodium bearing a rosette of broadly spoon-shaped leaves with very turbinately swollen petioles and very numerous adventitious roots. From the centre of the rosette rises a sheathed scape 6–10″ high of volet-blue flowers.

Frequent in Orissa. Fl. h.s. This plant now forms a *sud* on the Irawadi and other Burmese rivers, and can be seen drifted far out to sea.

FAM. 149. AMARYLLIDACEÆ.

Herbs, or large stout shrubs with short or elongate usually unbranched stem and a terminal crown of rigid leaves; stock bulbous tuberous or a corm or rhizome, rarely merely fibrous. Leaves usually radical or clustered at the apex of a caudex, sometimes shortly distichous, thick and fleshy or narrow with parallel venation, rarely plicate or broad or petioled. Flowers 2-sexual regular or somewhat zygomorphic, often showy, most often umbellate and with an involucre of one or more spathaceous bracts on the top of a naked spathe; sometimes umbel reduced to one flower, more rarely flowers cymose or panicled and then sometimes panicle gigantic. Hypanthium sometimes produced into a beak above the ovary. Perianth often tubular at the base, tepals 2-seriate, usually both series similar and petaloid but sometimes different. Stamens 6 on the bases of the tepals, rarely epigynous, filaments mostly alternately longer and shorter, rarely connate at base, but frequently with stipular appendages or petaloid appendages which may become

variously connate and form a staminal corona; in other cases the corona appears ligular in origin and the filaments arise from the inside of it. Anthers erect or versatile, extrorse or introrse. Ovary inferior, 3-celled. Style usually undivided, stigma subcapitate or 3-lobed. Ovules usually many and 2-seriate in each cell, rarely few. Fruit mostly loculicidal, very rarely baccate. Seeds numerous or few. Embryo small straight eccentric, enclosed in albumen.

I. Leaves clustered at the top of a more or less well-developed caudex or (*Polianthes*) rootstock pseudo-bulbous on a rhizome and then scape leafy at base. Scape simple or branched, flowers racemose on the rhachis or its branches or cymose on the branches :—
  A. Very robust plants with large thick fleshy or coriaceous often spinose leaves on a stout erect thick caudex. Scape very large or gigantic :—
    Perianth-tube usually short. St. exserted. Style filiform . . . . . 1. *Agave.*
    Per.-tube hardly any. St. included, fil. and style swollen at the base or below middle . . . 2. *Furcræa.*
  B. Herbaceous with tuberous or pseudo-bulbous rhizome. Fls. paired in each bract on a long raceme, bracts foliaceous below. Perianth-tube long dilated above . . . . . *Polianthes* (p. 1107).

II. Leaves all radical from a bulb, rarely a corm or slender rhizome. Scape leafless, never on a well-developed aërial caudex, sometimes appearing at a different time from the leaves :—
  A. Leaves from a tunicate bulb, never plicate. Scape naked, bearing at the top 1 or more membranous involucral bracts and an umbel of usually showy flowers or a solitary fl. :—
    1. Stamens not united by a membrane. Squamellæ rarely present around or between the stamens :—
      a. Scape 1-fld. (or 1–5-fld. in *Hippeastrum*) :—
        i. Bract 1 (sometimes 2-fid. in *Zephyranthes*):—
          Per.-tube 0. Squamellæ small. Fls. with leaves, large, zygomorphic . . . *Sprekelia* (p. 1107).
          Per.-tube long. Squamellæ small or 0. Often fl. before leaves. Crocus-like fls. . *Zephyranthes* (p. 1107).
        ii. Invol. bracts 2 distinct. Fls. before leaves, large . . . . . *Hippeastrum* (p. 1107).
      b. Scape with usually many fls. in the umbel, often mixed with filiform bracts. Corona or squamellæ 0 :—
        i. Ovules many closely sessile or subimmersed in the fleshy placentæ :—
          Fls. sessile or nearly so. Per.-tube long, usually narrow . . . . . 3. *Crinum.*
          Fls. pedicelled, declinate, tube short, lobes oblong-lanceolate . . . . *Amaryllis* (p. 1109).
        ii. Ovules distinct from the placenta :—
          † Ovules 2-seriate superposed, many. Fil. connate at base . . . . . *Nerine* (p. 1109).
          †† Ovules 2 or few in the middle of the cell :—
            Ovules 6. Fls. large with the leaves . *Clivia* (p. 1109).
            Ovules 1–2 collateral. Fls. relatively small in dense umbels before the leaves . *Hæmanthus* (p. 1109).
    2. Stamens united into a cup by the corona :—
      a. Leaves broad, perianth lobes broad :—
        Ovules many, rarely 2–3 superposed. Tepals patent . . . . . *Eucharis* (p. 1110).
        Ovules 2 collateral in the middle of the cell Tepals erecto-patent . . . . . *Eurycles* (p. 1110).

b. Leaves narrow. Perianth lobes narrow or filiform :—
Ovules many superposed . . . . 4. *Pancratium.*
Ovules 2 ascending from the base . . . 5. *Hymenocallis.*
B. Leaves usually plicate and petioled, from a corm or slender tuberous rhizome. Scape very short, sometimes subterranean. Fls. usually yellow, not large, solitary racemed or capitate :—
Hypanthium produced into a beak above the ovary. Stigmas erect appressed. Fruit indehiscent . . 6. *Curculigo.*
Hypanthium not produced into a beak. Stigmas erect stout distinct or connate into an oblong mass. Frt. circumsciss . . . . . 7. *Hypoxis.*

1. AGAVE, *L.*

Stout shrubby rhizomatous plants with a short aërial stem more or less concealed by the leaf-bases, and with thick fleshy spine-tipped and often spinosely toothed rigid leaves. Hypanthium produced into a short stout beak above the ovary. Perianth more or less funnel-shaped or campanulate with the tube short or very short, rarely elongated, lobes linear, erect or spreading. Stamens inserted at the base of the tepals and considerably longer than these with filaments filiform or flattened at the base, anthers large linear, fixed by the middle of the back. Ovary often fleshy 3-locular, style filiform above the short conical base. Ovules very numerous in each cell. Fruit an ovoid globose or cylindrical coriaceous erect beaked capsule, crowned at first by the sub-persistent perianth, loculicidally dehiscent at the apex. Seeds numerous, flattened, closely superposed with black testa.

The inflorescence varies much in the different sections and is either spicate with flowers sessile or shortly pedicelled, solitary in the bracts or 2 or more in each bract, or the inflorescence is panicled, the flowers closely aggregated in peduncled erect cymes on the spreading branches of a gigantic scape (" pole " of growers). The genus is entirely American.

The *Agaves* are usually propagated by bulbils which are often formed in place of or in addition to the fruits.

The following descriptions are mainly taken from " Notes on *Agave* and *Furcræa* in India," by *J. R. Drummond* and *D. Prain* (*Agricultural Dept. Bulletin*, No. 7 ; 1906).

I. Leaves over 3 ft. in length, in a lax rosette or tufted :—
A. Perianth segments not constricted towards the tip :—
1. L. broadest in the middle, tapering to both extremities :—
L. oblong-lanceolate, neck sharply constricted . . 1. *americana.*
L. linear-oblong, neck not constricted . . . 2. *vera-cruz.*
2. Leaves linear-lanceolate, hardly widened in the middle . 3. *cantula.*
B. Perianth segments narrowed from about the middle to a ligulate tip :—
L. straight and narrow, often spineless . . . . 4. *sisalana.*
II. Leaves never exceeding 3 ft., in a close globose rosette . . 5. *Wightii.*

1. A. americana, *L.*

Leaves very stout, commonly variegated yellow, sharply constricted into a neck just above the very swollen bases, margin distinctly

sinuate and bearing the mostly reflexed spines on the eminences, apical spine 1–2″ long.

It is a common ornamental plant in gardens throughout the province, and is said to be the species from which the Mexican drink "pulque" is prepared (from the scapes).

Trunk short stout usually hidden by the thick leaf bases. L. lanceolate, many in a lax rosette, sometimes rather glaucous, spreading at base, then ascending, and finally with tips often recurved, 4–6 ft. long and up to 1 ft. broad above the middle (the widest part). Marginal spines strong dark brown, margins becoming involute for about 3″ from the tip and hardening, ultimately horny and forming the terminal slightly grooved dull brown 1–2″-long spine. Scape with panicle 15–25 ft. high, primary branches almost horizontal, fascicles of fls. crowded at the ends of subsidiary ascending branches. Ovary faintly sulcate, about equalling perianth or shorter. Tepals ovate lanceolate, tips obtuse, amber-coloured as are fil.; pollen orange; style faintly 3-lobed. Capsule bluntly 3-gonous or oblong-cylindrical, rather broader upwards.

2. **A. vera-cruz,** *Miller.* Syn. A. cantula, *Beng. Pl.*; Muraba, *K., S.* Murba, murga are common vernacular names for agaves, aloes, etc. Mordha is also given as a vern. name in the *Notes.*

A stout plant usually producing numerous shoots from the rhizome, which render it polycarpic. Leaves very deep green and glaucous, linear-oblong, 4–6 ft. long and attaining 10″ in width, scarcely constricted above the base, margins not or only slightly sinuate, apical spine ·5–1″ long, dark brown.

Tirhut, in hedges, *D.* & *P.* More or less naturalized in Singbhum (*e. g.* near Anjedbera)! Hazaribagh, Daltonganj (Palamau), etc.! Balasore! Fl. Sept.–Dec.

Trunk short, hidden by the thick leaf bases. L. often rather concave at the widest part (just above the middle), early curving upwards and ends more or less recurved, sage-green, interval between spines ·5″ or less, rarely ·75″, marginal spines spreading or decurved, black or dark-coloured. Main branches of panicle 3-chotomous, curved or flattened. Fls. in pairs with a subsidiary bud laterally developed at a different level; tepals linear-lanceolate, pale amber tint, cup herbaceous, anthers ·5″ and more, much exserted, pollen dark yellow. Ovary smooth cylindric longer than perianth, style very faintly lobed. Capsules rather turgid, oblong-cylindric, tip rounded, seeds black, shining.

3. **A. cantula,** *Roxb.*

Leaves in a lax but even tuft from a short ascending rhizome, pale-green, older darker, sometimes glaucous, attaining 4 ft. or more, but usually only 2·25″ broad, rarely over 3″ at the widest part (just above the middle), apical spine usually acicular, ·5–1″ long, reddish or dark brown, marginal spines conspicuous falcate pointing forwards, ·25″ or more and very sharp. Flowers 1–2 together, tepals 1·5″, linear-oblong obtuse, greenish-yellow.

Tirhut, *D.* & *P.* Cultivated at Hazaribagh Jail, *Wood.* Cultivated at Sambalpur!

L. linear-lanceolate, very narrow, curving gradually outwards from the moderately thick base, or in weak specimens bent over almost from the base, upper surface more or less concave, sometimes trough-shaped in the lower portion, marginal prickles always ascending, pale brown or garnet-coloured, from a small light-coloured cushion. Scape with panicle 12–18 ft. high, inflorescence on flexuous rather slender branches, fascicles 1–2-fld. Ovary equal or shorter than perianth. Tepals bluntly linear-lanceolate, 1·5″, or linear-oblong, greenish yellow, obtuse, free almost to their bases, 1·5″ long, cup hardly any.

4. **A. sisalana,** *Perrine.* Sisal Hemp.

Rhizome sometimes ascending, hidden by the leaf-bases. Leaves closely tufted, not at all constricted above the moderately thick base, deep green, glaucous or not, up to 6 ft. in length and 10″ in breadth, marginal prickles 0, or if present weak scattered and pale.

Introduced into Tirhut, Ranchi Jail, the Santal Parganas, etc., for the sake of its fibre. It is stated that a somewhat poor land of a loose stony nature is best suited to produce good fibre.

L. not forming a rosette, but closely tufted on the rhizome or on a very short ascending caudex completely hidden by their moderately thick bases, inner making a very sharp angle with the axis, the outer gradually receding, but still making less than a right angle, widest part just above the middle; terminal spine not channelled, glossy, purple or dark brown. Scapes with the panicle 15 ft. or more, fascicles of fls. rather crowded, ovary equal or shorter than perianth, slightly broadened upwards. Base of per. convex and somewhat dilated, limb suddenly contracted, segments narrowly ligulate, tip slightly hooded. Style long, stigma faintly lobed.

5. **A. Wightii,** *Dr. & Prain.* Syn. A. vivipara, *Wight.*

Leaves ensiform linear-lanceolate, very many, forming a stiff even rosette 3–5 ft. diam., pale green often tinged with ashy grey, base thin, broadly amplexicaul, attaining 3 ft. in length, but not usually more than 2·5″ wide, flat or very slightly convex. Marginal prickles rather weak about ·75″ apart, spreading or erect, terminal spine about ·5″, pale, slightly decurrent.

Tirhut (Tarkaulia), *D. & P.*

Trunk stout, usually conspicuous, ascending throughout or partly procumbent L. sometimes attaining 3·5″ in width at the middle (the widest part), marginal prickles usually consisting of a small brown cushion carrying a semi-transparent garnet-coloured spine which is often sharply recurved parallel to the leaf edge, but ends in a finely barbed hook which invariably points upwards. Scape 12–15 ft. high with the oblong-pyramidal panicle, main branches short 3-chotomous, fascicles rather crowded. Ovary nearly spindle-shaped, rather shorter than the perianth and constricted below it. Per.-cup soon dividing into lanceolate segments, each ending in a narrowly ovate lanceolate limb which is slightly thickened at the obtuse tip and (in dried specs.) obscurely hooded, greenish yellow. Capsule brown, very broadly turbinate, 1·25–1·5″ long, rostrate by the hardened bases of the tepals. Seeds opaque dull black.

2. FURCRŒA, *Vent.*

Habit of *Agave*, stem erect, often elongated and marked with the scars of fallen leaves. Leaves densely clustered, spinose-dentate or entire. Perianth with scarcely any tubular portion, the tepals being free nearly or quite to the base and with the segments spreading and more or less ovate-oblong instead of linear. Stamens at the base of the tepals and shorter than these, erect, lower part of filament swollen, above shortly subulate. Ovary oblong 3-celled, contracted into a beak, style columnar swollen below the middle, prominently 3-angled. Ovules many in each cell, 2-seriate. Capsule ovoid or oblong, loculicidal.

1. **F. gigantea,** *Vent.* Mauritius Hemp.

A noble-looking plant when well grown with large vivid green leaves 6 ft. and more long, scarcely armed, and immense panicles of greenish pendulous flowers, attaining 30 ft. in height.

Frequent in gardens, though not, I believe, grown for its fibre.

Drummond and *Prain* state that there is a doubt about the name, and had not seen the flowers. *F. gigantea* according to *Baker* has a brown pungent point to the leaves, whereas in our plant it is green and scarcely pungent. The leaf of *Baker's* plant is described also as only ⅛th in. thick in the middle as against ·5–·75″ thick in our plant.

Scape with panicle 10–15 ft. high. Flowers pendent on slender pedicels and about 2″ long. Hypanthium ·7–·8″ long, rather slender, slightly pulvinate on the pedicel. Outer tepals narrowly elliptic 1·2″ long by ·4″ broad, obtuse, inner elliptic subequal in length, ·6″ broad, all white and free to the base. Stamens appressed to but not adnate to the stylar column, ·4–·5″ long, flattened throughout, oblong at base, then much dilated in middle and finally acuminate, bearing a stout oblong versatile anther ·12″ long. Stylar column stout deeply 3-lobed for ·3″, each lobe with a 2-lobulate cornice above which the column has a tapering beak ·4″ long bearing a sub-simple obscurely 3-lobed stigma perforate at the apex.

Polianthes tuberosa, *L.* The Tuberose.

A very beautiful plant, the scapes leafy below and 2–4 ft. high from a rhizome, with bulbous swellings. L. linear. Flowers white, very fragrant, funnel-shaped, the tube being expanded above and bearing suberect segments. Inflorescence racemose with two fls. in the axil of each bract.

Very common in gardens and verandahs.

Sprekelia formosissima, *L.* Jacobæa Lily.

A bulbous plant with a hollow scape bearing vertically on the top a single large crimson flower about 4–6″ across. Tepals unequal, inner clawed, one broader than the others, which are recurved. Native of Mexico.

Zephyranthes spp. Zephyr-flower.

Beautiful crocus-like plants with narrow grass-like leaves usually appearing after the first flowers, but the flowering commencing in the h.s. also continues after the appearance of the leaves. Perianth more or less funnel-shaped, white, rose or yellow. Very commonly cultivated. The species are probably *carinata* and *rosea* with rose-coloured flowers, *candida* (or *tubispatha* ?) with white and *flava* with yellow flowers.

Hippeastrum spp. Knight's Star-lily (sometimes called Amaryllis).

Beautiful flowering bulbs usually producing (as known in our area) the scapes in the h.s. before the leaves appear. Flowers large funnel-shaped 1–5 sheathed by 2 membranous bracts, inclined horizontally or downwards, somewhat zygomorphic with declinate stamens, brilliantly coloured. Stamens shorter than the perianth. L. linear. Frt. capsular, seeds many flat.

Very common in gardens. Natives of tropical America. The garden varieties are mostly hybrids. In its native state the genus has usually a number of flowers in the umbel.

3. CRINUM, *L.*

Stout bulbous herbs, sometimes with a considerable aërial stem. Leaves fleshy, elongate, lorate, ensiform or somewhat lanceolate. Flowers large in umbels subtended by 2 spathaceous bracts and with linear bracts to the flowers. Perianth funnel- or salver-shaped, straight or upcurved, with linear to oblong lobes and no corona. Stamens on the throat, erect spreading or declinate : anthers linear, dorsifixed, introrse, often curved. Ovary 3-celled with filiform style and minute stigma. Ovules few or many. Fruit large, subglobose, membranous or coriaceous, irregularly breaking up. Seeds few large rounded with thick testa and very copious albumen.

The following species are indigenous in our area ; others may be found in gardens.

A. Leafy stem not dying down annually. Fls. white, with the leaves :—
Erect, caulescent. Leaves 4–7″ wide . . . . . 1. *asiaticum*.
Prostrate or aquatic or at least scape declinate. L. under 3″ wide . . . . . 2. *defixum*.
B. Leaves dying down annually. Flowers before leaves are mature, very large, with tepals 1″ broad, often rosy . . 3. *latifolium*.

1. **C. asiaticum,** *L.* in part, not of *Roxb.* Syn. C. toxicaria, *Roxb.* ; Bara-kanur, *Beng.* ; Arsa, *Or.* ; Hathikanda, *H.*

A very robust herb with large stout erect caudex up to 3 ft. high and 4″ diam. Leaves oblong-lanceolate 3–4 ft. long. Scape 2 ft. strongly compressed. Flowers over 20 (up to 50, *Roxb.*) in the umbel, shortly pedicelled with a slender tube 2–2·7″ long and linear spreading tepals 2″ long. Fruits broadly ellipsoid about 1″, few-seeded.

On the higher sandy ground fronting the sea, in the Cuttack deltaic jungles ! Also apparently wild, but usually near villages in the Purneah jungles ! Fl. at all seasons. Common in gardens. I have recorded from Purneah *another* large *Crinum*, apparently wild, but neither in flower nor fruit, and which I now think was probably young plants of this species.

Bulb not much wider than the rest of the stem. L. 5–7″ wide in the middle, striate beneath. Flowers rather small for the size of the plant and perianth never rosy as in some other species. Pedicel and ovary together ·7–1″ long. St. spreading and recurved with white or pink filaments and brown versatile linear straight or curved anthers. Style erect pink exserted 1–1·5″. Spathe bracts 2, lanceolate, 3·5″ ; inner bracts filiform. Seeds large rugose.

2. **C. defixum,** *Ker.* Syn. C. ensifolium, *F.B.I.* ; C. asiaticum of *Roxb.* ; Sukh-darshan, *Beng.* ; Kondai, *Or.* ; The Ditch Crinum.

A stout herb with the leaves erect in water, or spreading on the soil from a very broad amplexicaul base 1·25–2″ wide, from which it gradually tapers to the tip, which is somewhat obtuse, length usually 12–18″, but it is difficult to find mature perfect leaves as they are usually bitten off. Scape from the outer leaf-axils, 1–2·5 ft. long, compressed, ·5–·7″ broad, ultimately declinate and resting on the water, soil or other herbage. Umbels 7–12-fld. with 2 spathaceous lanceolate or broadly lanceolate bracts with rounded tip, 2·5–3″ long, greenish membranous, finally scarious ; floral bracts filamentous with clavate tips. Perianth-tube 3·5–4″ slightly exceeding the spreading white linear or linear-lanceolate tepals, which are 3–4″ by ·4–·5″ when spread out, but they are somewhat conduplicate or incurved in nature, and partially enclose the bases of the rather shorter pink filaments. Anthers very slender, linear, ·7–·9″ long, very slightly curved with yellow pollen, the anther appearing at first yellow and finally turning black. Fruit with membranous pericarp, globose, beaked with the long perianth tube, 1–2-seeded.

Along muddy banks of rivers and often immersed, throughout Chota Nagpur ! Gangpur ! Sambalpur ! and also along the sea front in wet mud and sandy pools in Puri and Cuttack ! in places where the plants must receive a considerable amount of salt. Fl. Aug.–Oct.

Fl. Aug.–Oct. Bulb 2·5–3″ diam., globose or ovoid, terminating suddenly in a neck or when ovoid passing gradually into a very stout neck 2·5–4″ long clothed with leaf-bases ; the bulbs are frequently (always ?) attached to a creeping rhizome. Leaves 12 or more on the bulb, often very concave or channelled above, margins hyaline and with sparse hyaline hairs especially towards the base. Perianth tube

straight or somewhat curved, according to the inclination of the scape, tepals soon stellately spreading. The plant does not appear often to set seed, but large greenish bodies, plano-convex or doubly convex, may be found floating about in the water in the cold season which are apparently bulbils; they are 1·2–1·5″ diam. and contain a clavate curved "embryo" of apparently homogeneous parenchyma with slightly green epidermis; the root end breaks through the outer tissues at any point. They are very similar to the seed-like bulbils found in the *Spider-lily* (*q.v.*).

Var. ensifolium *Baker*. Syn. Crinum ensifolium, *Roxb.* (and in *F. B. I.*).

Baker includes *ensifolium* as a variety of *defixum*—I think correctly, unless it is merely a form. It only differs by the *ensiform* leaves tapering gradually from base to apex. Many plants occur in which it is doubtful whether they are referable to *defixum* or *ensifolium*.

3. **C. latifolium,** *L.* Syn. Amaryllis latifolia, *Willd*; Sikiyom-baha, *S.*

A beautiful species flowering before the leaves are fully developed and bearing 8–10 large white inclined or drooping flowers more or less tinged with rose along the centre of the tepals, tube 4–5″, lobes erect 3·5″ oblanceolate and 1″ broad, terminating in a sharp cusp and a curious reflexed villous appendage ·2–·25″ long, from the inside of the cusp, very delicate and rose-hyaline. Stamens declinate included, about ·75″ long; anthers white, grey or black, usually curved into a semicircle before dehiscence, linear-oblong. Style pink. Fruit 2–2·5″ diam. with membranous epicarp striate with about 25 vertical lines.

In dry jungles, though often on the (high) banks of rivers. Singbhum! Manbhum, *Campbell*! Palamau! Hazaribagh (Tatijheria jungles)! Gangpur! Fls. May–June. The leaves appear in June and die down in the c.s.

Bulbs globose 5–5·5″ diam. with a long stout neck 3–5″. Leaves ultimately many, 30″–4 ft. long by 3–4·5″ wide in the middle (whether or not the margins are denticulate in our plant as described by *Roxburgh* for his *latifolium* I am unfortunately unable to say as leaf-specimens have not been kept and this point was not noted. Such denticulate leaves however I have from an up-country specimen which otherwise appeared similar). Scape about 12″ by 1″ wide, compressed. Spathe-bracts 2, lanceolate, 2·7–3″ long, sometimes tinged rose. Floral bracts linear, 3″. Tube straight or slightly curved. Ovary sessile ·75″. Seeds about 12, large, but very variable in the same capsule, angular.

Roxburgh lays stress on the colour of the anthers, but unless there are 2 species in our area included by me here (which is unlikely), this appears to be of no importance, and a similar conclusion is reached in the case of *C. defixum*.

Amaryllis belladonna, *L.*

A beautiful plant, often, not always, flowering with the leaves. Flowers zygomorphic, soft rose-colour shading into white within, in an umbel with an involucre of 2 spathes. Ovules sunk in the placenta. Capsule 3-quetrous, seeds roundish.

Nerine spp. Guernsey Lily.

Usually grown in verandahs. Fls. not very large, in umbels with narrow perianth; segments recurved. Stamens swollen and connate at the base. Ovary small oblong.

Clivia nobilis, *Lindl.*

Less common. A stout plant flowering with the leaves. Perianth segments and stamens erect, orange red. Native of the Cape.

Hæmanthus Kalbreyerii.

A very handsome plant bearing before the leaves develop large globose umbels of

very many rather small scarlet flowers with far-exserted stigmas. Bracts of the involucre coloured.

L. in a large tuft, oblong, closely tesselately nerved.

Usually grown in verandahs and grass greenhouses.

Eucharis grandiflora, *Planch* (better known as E. amazonica, *Lindl.*).

A very beautiful plant with a crown of ovate-lanceolate petioled leaves and scapes of usually 5–7 large pedicelled pure white firm, almost wax-like sweet-scented flowers 3″ diam. with spreading broad perianth-segments. Tube widened in the throat and with a complete erect staminal cup undulate or 2-lobed between the stamens. Involucral bracts 2–3, floral narrow. Ovules many in each cell, 2-seriate superposed. Fruit 3-dymous, depressed globose. Seeds large.

Found in nearly every European plant-house or verandah. The leaves never completely die down.

In **E. candida**, *Planch*, there are only 2 ovules in the cells and the staminal membrane is interrupted except at the base. It is not common.

Eurycles amboinensis.

Habit similar, but foliage more handsome, flowers less so. L. large orbicular-cordate, petioled. Fls. several in the umbel. Perianth with slender tube and broad erecto-patent segments. Staminal-membrane with a broad toothed or lobed margin each side of the filament and cut almost to the base between. Ovules 2 collateral in each cell. Capsule globose.

Very common in gardens and plant-houses.

4. PANCRATIUM, *L.*

Bulbous herbs with linear or lanceolate radical often 2-farious leaves. Flowers large umbelled or solitary on a solid scape, with 1–4 membranous spathes and linear hyaline bracts. Perianth funnel-shaped with long or short tube and narrow lobes. Stamens on the throat of the perianth, filaments united by a toothed or lobed membranous corona, anthers dorsifixed. Style filiform, stigma small. Ovules many superposed in each cell. Capsule large, subglobosely 3-angled, loculicidal. Seeds angled with lax black testa.

A. Scape longer than the flowers. Perianth-tube 3–4″, longer than the segments :—
Spathes 1–2. Fls. 3–5, filaments (free part) longer than the 10-toothed (each sinus 2-fid or 2-toothed) corona . 1. *triflorum.*
Spathes 3–4. Fl. 2–3. Filaments about equal to the crose corona . . . . . 2. *biflorum.*
B. Scape much shorter than the flowers. Perianth-tube 4·5–6″. Sinuses of corona oblong 2-fid . . . . . *longiflorum* (p. 1111).
C. Perianth-tube 1–2″ :—
Spathes 1–2. Fls. 2–4, filaments somewhat longer than the corona, sinuses 2-toothed . . . . . 3. *verecundum.*

The species seem to be rather confused, and to make the plants referred to here clearer I have compared them with the following unpublished drawings at Kew as follows :—

No. 1049 (*Roxb. Ic. ined.*) I take to be *P. verecundum*, *Ait.*, but not *P. verecundum* of *F.B.I.*, where *Hooker* says the tube is 3–4″ long. *Ailton* says that it is scarcely 2″.

No. 1960 (*Roxb. Ic. ined.*). This is undoubtedly *Roxburgh's P. biflorum.*

No. 556 (author ?). I take this to be *P. triflorum*, *Roxb.*

I believe (from noting specimens growing) that both relative and absolute lengths of scape and perianth-tube are really characters of little taxonomic value. In this case *longiflora* may pass into *triflorum.*

1. **P. triflorum,** *Roxb.* (not of *F.B.I.*). Gering-ba, *K.*

A very pretty plant with scapes from 2–4″ to 12–18″ above ground, bearing 3–5 flowers subtended by 1–2 (usually 2) membranous spathes.

Tube slender, 3–4″ long, tepals rather shorter, 2·5–3″ or only 2″ by ·2″, outer linear-oblanceolate, inner rather shorter and broader, all mucronate or apiculate, pure white. Corona about $\frac{3}{4}$ths. as long as perianth or 1·5″ long, obconic, including the ·3–·5″ long teeth, of which there are 2 between each stamen, free part of filament ·4–·7″ long with yellow slightly curved anthers ·2″ long. Fruit globosely ellipsoid, ribbed, on a pedicel ·3–·4″ long.

Frequent in the forests. Singbhum, esp. Porahat! Ranchi! Palamau! Fl. April–May.

Bulb globose 2″ diam., with or without a neck according to the state of the brown sheaths forming it, usually neck 2″ long. L. about 6″ by ·5″ at time of flowering. Spathes ·7–1·5″. Per.-tube scarcely angled, outer tepals more acute than the inner. Teeth triangular, acuminate or acute.

It would be a very ornamental garden plant, but that the flowers only open at evening and fade on the following day. The scent is faint and not very pleasant.

2. P. biflorum, *Roxb.*

This is distinguished from *P. verecundum* by the 3–4-merous spathe, and flowers 2–3 only in which the corona between the filaments is not prominently toothed but erose. The corona is broadly funnel-shaped and scarcely one-third the length of the corolla.

It was recorded by me in the *For. Fl. Ch. Nagpur* and in *Bengal Plants*, but there are no specimens in the *Calcutta Herbarium*, or in my herbarium nearer than Raipur (in the Central Provinces), and I suspect that specimens of *P. verecundum* were taken for it.

Roxburgh's drawing (*ined.* No. 1960) agrees well with his description. It shows 2 fls. only and 4 spathes. Perianth tube 4″ and long linear segments 3·5″, corona 1·3″ erose between the stamens. Leaves over 1″ broad. *Baker* says *P. biflorum*, *Ait.* = *P. verecundum*, *Ait.*, but *Aiton* says that the lobes of the corolla in *verecundum* are 2-fid and in other respects the two are very different.

P. longiflorum, *Roxb.*, is frequent in the Central Provinces and is likely to be found on the western plateaux of our area. It has a globose or bottle-shaped bulb 2·5″ diam. with a long neck. The scape is remarkably short, only 1–2″ high, whereas the perianth-tube of the 1–2 flowers is 4·5–6″ in length of a pale green colour. Tepals white lanceolate 2–2·5″. Corona 1–1·5″ long including the oblong 2-horned segment between each filament, free part of filament about as long. Fl. June.

3. P. verecundum, *Ait.* Syn. P. triflorum, *F.B.I.*; Ku-kanda, *Or.*

Scapes 1–2 from the bulb, 6–10″ long (without the flowers), 3–4-fld., spathes oblong-lanceolate 1″. Pedicels 3-gonous, ·3–·4″ long. Perianth-tube slender for about ·7–1″ only, then funnel-shaped for about ·7″, segments lanceolate recurved slightly shorter than the tube, ·25–·3″ broad. Corona campanulate with 2 large equal acute lobes between each filament.

Kalahandi! Fl. May.

Bulb globose 1·5″ diam. with a stout neck. *Aiton* describes the leaves as about 1·5 ft. long and ·5″ broad, and the drawing quoted above, which I take to be this species, shows the plant flowering with 7–8 leaves 6–12″ long by ·5–·6″ broad, but the leaves in my specimen were quite young. Corona in my specimen ·6–·7″ long and free part of filaments about 1″, anthers pale yellow, ·3″.

5. HYMENOCALLIS, *Salisb.*

Bulbous herbs with leaves lorate or somewhat broad and contracted into a petiole. Scape solid with 2 involucral spathe-bracts, inner

floral bracts linear. Perianth sub-hypocrateriform with the long tube little or not widened at the apex, tepals linear. Stamens inserted at the top of the tube, filaments united at the base by a cup-like corona, anthers linear dorsifixed, often curved. Ovary 3-celled, with 1–2 erect basal ovules in each cell or some of the loculi empty. Seed often 1 only perfect, large, green with a hard spongy testa.

An American genus described here on account of the wide-spread cultivation of the following species (which I have never yet seen assigned to its proper genus in Calcutta horticultural collections), and on account of its interesting bulbils. There is a closely allied species, *H. littoralis, Salisb.*, which is very similar.

1. **H. tenuiflora,** *Herb.* (App. 44, 1821.) The Spider-lily.

A stout bulbous herb with ovoid bulb 2–2·5″ diam. not much wider than the stout neck which is covered with leaf-sheaths. Leaves 15–27″ by 1·5″, 2-farious, lorate with acute or subacute apex and amplexicaul base, obtusely keeled. Flowers with the leaves, 7–20, delicately-scented, on flattened fleshy scapes longer than the leaves. Spathes 2, broadly-lanceolate. Perianth-tube 5–6″ slender, tepals spreading linear cuspidate, 4–4·5″ by ·2–·3″. Coronal cup 1·5–2″ diam. white membranous, 1–1·5″ long, free part of filament 2″, anthers linear straight 1″ long with deep orange pollen.

In gardens and verandahs everywhere and grows freely near water in the Calcutta gardens. It never set seed with me, but produces together with the ovaries irregularly spindle-shaped or obovoid green bulbils 1–1·25″ long. These have no distinct skin, but at the time of germination is differentiated a central core occupying the long axis and from which grows a hypocotyl-like structure emerging near the original point of attachment of the bulbil, and acts generally like an embryo, first forming roots and then an erect stem, while the other blunt end remains in the bulbil, to which it is attached by a small-celled absorptive tissue.

6. CURCULIGO, *Gaertn.*

Herbs with a tuberous rootstock or corm and radical or shortly cauline plicate and lanceolate or linear smooth leaves. Flowers usually yellow and unisexual, spicate racemed or subcapitate on a scape sometimes lateral to the leafy stem or tuft. Hypanthium produced above the ovary as a solid stipes bearing the rotate perianth, or perianth subsessile (in sec. Moliniera). Stamens at base of perianth, short, anthers erect dorsifixed, sometimes cohering. Fruit indehiscent, usually more or less beaked. Seeds subglobose or ellipsoid with crustaceous shining testa beaked at the hilum.

Hypanthium markedly beaked. Flowers few small . . .	1. *orchioides.*
Hypanthium not or scarcely beaked. Fls. capitate, many .	2. *recurvata.*

1. **C. orchioides,** *Gaertn.* Turam, *K.*; Musor, Musal-khand, Kala-musali, *H.*; Tallura, *Beng.*; Kua-kenda, *Or.*

A small herbaceous plant, first conspicuous after the jungle fires by its small bright-yellow flowers ·5–·75″ diam. which rise just a little above the soil, accompanied by or shortly followed by the new leafy shoot with plicate linear-lanceolate leaves 6″ by 1″ attaining 18″ by 1·5″ with age, tapering into an elongating petiole. The flowering scape is sheathed with long lanceolate hairy bracts and is for the most part beneath the surface of the soil, above which the flower-buds

are thrust by the elongating beak of the hypanthium. Capsule sessile in the axil of a bract, ·6–·7″ long with short beak and villous tip, rather fleshy, with spongy septa, 1–4-seeded.

Common in the forests throughout Central and Southern areas, especially on clay soils! Fl. May–Aug. Leaves appear in June and die down the following cold season. Perennial.

Rootstock of long tubers about the thickness of a lead-pencil, and base of stem with many fibrous sheaths. L. with microscopic white dots above and with sparse silky hairs when young, tapering imperceptibly into a petiole which may attain 6″ at the end of the rainy season. Rhachis of spike quite hidden by the sheathing bracts. Flowers few, opening in succession, or 2–3 together, only the lowest usually hermaphrodite or female. Tepals dimorphic, male ·25–·3″, herm. ·5–·7″ long, oblong, hairy without. Anthers green or yellow. Stigma linear 3-cleft. Seeds black shining with faint wavy ridges and a peculiar hooked white strophiole or beak ·12″ long.

The roots are used in medicine and are considered alterative and tonic. The Kols boil and eat them. The powdered root is also used for bruises by the Oriyas.

2. **C. recurvata,** *Dryand.*

A stout herb with plicate palm-like leaves 2–3 ft. long by 3–7·5″ broad and long petioles 1–2 ft. long. Flowers yellow ·6–·75″ diam. in dense cernuous heads 2–4″ diam. on compressed villous scapes 3–9″ long. Ovary turbinate scarcely beaked. Fruit globose hairy, ·25–·3″ diam.

In shady marshy localities in the forests. Singbhum! Puri! Fl. April–June. Rootstock tuberous. Leaves curved, lanceolate or broadly lanceolate, petiole channelled and hairy below. Bracts ovate-lanceolate acuminate, more or less hairy. Pedicels ·25″. Filaments very short and anthers cohering. Stigma minute. Seeds black, deeply closely grooved.

A handsome plant with the leaves like those of young palms, and, like many others with plaited surface, displaying a continuous wavy motion even when there appears to be no breeze.

7. HYPOXIS, *L.*

Herbs with rootstock tuberous or a corm. Leaves radical narrow, strongly nerved but scarcely plicate. Flowers solitary, racemed or umbellate with rotate 6-partite persistent perianth not raised on a beak of the hypanthium. Stamens 6 on the base of the perianth, with short filaments and erect dorsifixed anthers. Ovary 3-celled; style short columnar, stigmas 3, erect stout distinct or connate. Ovules 2-seriate. Fruit capsular, 3-valved or circumsciss below the top. Seeds subglobose, testa crustaceous shining, beaked at the hilum.

1. **H. aurea,** *Lour.*

A small plant not usually more than 2–4″ high at the time of flowering, from a short erect sub-cormose rootstock about ·7″ long with fibrous or not very fleshy roots. Leaves very narrow, about the length of the scape when in flower by about ·1″ broad, elongating to 6″ by ·2″ when mature, scarcely plicate, usually recurved, nearly glabrous or rather hairy. Scapes 2–3″ long with 1–2 linear bracts, sparsely hairy with spreading hairs above, sometimes 2-flowered, bracts ·3–·4″ long in fruit. Fls. 2-sexual, with the ovary quite evident below the perianth (which is not the case in *Curculigo*, with which the species is sometimes confounded). Tepals ·25″ long ell.-lanceolate

or ell.-oblong, anthers ·06″ and filaments nearly twice as long. Capsule cylindric-turbinate ·5″ long, crowned by the marcescent perianth.

Amongst grass in open jungle but not common. In the hills. *Pâts* of Chota Nagpur! Parasnath! Fl., Fr. June–July.

The leaves sometimes attain 12″ long, but have not been seen so large in our area. *Curculigo orchioides* has sometimes been called "*H. aurea*, male fl." in herbaria. It can easily be distinguished by general habit as well as by the anthers being ·12″ long and twice as long as the filaments.

FAM. 150. TACCACEÆ.

Tuberous-rooted herbs with large radical petioled, sometimes deeply partite, lobed or pinnatifid leaves. Flowers densely umbellate at the apex of a leafless scape, outer spathe bracts broad, often 4, herbaceous or coloured forming an involucre to the umbel, inner filiform, overtopping the flowers and drooping. Perianth petaloid or sub-herbaceous, broadly urceolate or globosely campanulate with a short broad tube often constricted at the mouth, lobes 6, 2-seriate, subequal or the inner broader, all conniving or outer or all very spreading. Stamens 6, inserted on the tube or base of the segments, included, filaments very short with dilated base or furnished on each side with a swollen fleshy process dilated above into an incurved interiorly 2-ribbed or 2-horned cowl with the anthers sessile inside the cowl, ovate or oblong with 2 longitudinally dehiscing cells. Ovary inferior 1-locular with 3 parietal placentæ, style short columnar, often 3-angled, included, with 3 broad, often petaloid stigmas reflexed umbrella-like over the style. Ovules many, anatropous or almost amphitropous. Fruit baccate or rarely at last 3-valved, often 3-angled or 6-costate.

1. TACCA, *Forst.*

Characters of the family :—Fruit baccate or indehiscent.

1. **T. pinnatifida,** *Forest.* Dhai, *K.*, *S.*

An interesting herb with a large globose tuber and long-petioled succulent leaves which remind one of some aroids, being 3-partite with each segment, very coarsely unequally pinnatifidly lobed. Flowers broadly campanulate, greenish, ·3–·5″ long on pedicels ·5–1″ long. Inner filiform bracts 3–4·5″ long. Fruit about 1″, 6-ribbed, yellow.

Among rocks in the forest and more open jungles. Singbhum! Manbhum! Hazaribagh! Fl. Aug.-Sept.

Tuber said to attain 12″ diam. in cultivation. L. 1–2 ft. wide, lower part of the segments with a sinuous, lobed or toothed wing and more or less oblong leaflets, upper part usually terminating in three very much larger elliptic or ovate leaflets 3–6″ long with often a wavy or lobed margin. Involucral bracts 4–12, subequal or very unequal and variously linear, oblong or acuminate or with 2-lobed tip, sometimes striped purple.

The tuber, which is acrid and poisonous when fresh, yields a nutritious starch when macerated and repeatedly washed with cold water.

FAM. 151. BROMELIACEÆ.

Herbs, rarely shrubby or arboreous, very often epiphytic, mostly with clustered radical rosettes of leaves spirally arranged with the

base amplexicaul and sheathing, often with white glistening scales and margins very frequently prickly. Inflorescence generally from the centre of the rosette, terminal, sessile or peduncled in spikes, racemes, or panicles often densely aggregated in heads, and frequently with brilliantly coloured bracts on the axis below the flowers and passing into the proper bracts of the flowers, sometimes also a crown of bracts or foliage leaves (as in the Pine-apple) terminates the axis. Flowers 2-sexual, usually regular. Perianth separable into 3-merous calyx and corolla, calyx persistent herbaceous or coriaceous, sepals free or connate, petals free or united into a tube below or entirely connate, frequently with 2 scales at the base within. Stamens 6, free or connate or one whorl free, the other connate, anthers introrse. Ovary inferior, half inferior or superior, if superior then sessile by a very broad base, 3-celled, style with 3 stigmas or stigmatose branches. Ovules in each cell indefinite, usually very many, anatropous. Fruit baccate, sometimes combined below into a syncarp, and often crowned by the calyx, sometimes dehiscent. Embryo small, at the lower end of the seed near the hilum in a small pocket or fork of the mealy albumen.

The family is exclusively tropical and sub-tropical American, but several beautiful plants of the family are common in India in grass conservatories, verandahs, etc., a few like *Pitcairnia* with long leaves white scaly on the undersurface are large plants and grow in the open.

Ananas sativus, *Lindl.*, is the Pine-apple, which is largely grown and is semi-naturalized in some of the warmer moister districts. There are also ornamental-leaved pineapples in gardens.

FAM. 152. DIOSCOREACEÆ.

Climbing, very rarely erect, herbs or suffruticose, usually from a tuberous rootstock or hard rhizome with fleshy and tuberous roots. Leaves opposite or alternate entire lobed or digitately 3–5-foliolate, palminerved and with reticulate venation between; petiole often angular and twisted at the base. Flowers regular, small or minute, usually dicœcious, rarely hermaphrodite, spicate, racemed or panicled. Perianth usually shortly tubular below, tepals 2-seriate, male and female sub-similar. Male with stamens inserted at the base of the perianth or on the lobes, 3 or 6 or 3 perfect and 3 staminodes, anthers small, pistillode sometimes present. Female with 3, 6 or 0 staminodes, ovary inferior, 3-quetrous and 3-celled (in our genera), styles 3 very short or stigmas sub-sessile entire or 2-fid, recurved. Ovules 2 superposed in each cell, pendulous, anatropous or subamphitropous. Fruit a 3-valved capsule or baccate. Seeds flat or globose with small embryo included in hard albumen.

1. DIOSCOREA, *L.* Yam.

Our only genus. Fls. 1-sexual, usually dicœcious. Capsule coriaceous, 3-winged with 2 flattened or winged seeds in each cell.

Although the wild Yams are of great importance as food to the forest tribes, very little reliance can usually be placed on the vernacular names, and I have heard the male and female plant of the same species called by different names by the same man. In general the deeper rooted yams are the most esculent and considerable labour is involved in digging up the tubers.

Key (A.) to Male Plants.

I. L. all simple. Stamens 6 fertile. Fls. sessile :—
A. Sepals broad. Male spikes usually stiffly spreading 2″ or less in length :—
1. Spikes not zigzag. Stems not alate nor continuously angled (they are sometimes ridged below nodes) :—
a. Whole plant, esp. inflorescence and shoots pubescent or tomentose :—
Bulbiferous. L. all opposite, broadly ovate or orbicular. Epipetalous stamens inserted on the petals . . . . . 1. *anguina*.
b. Glabrous, or inflorescence slightly pubescent (rarely shoots somewhat pubescent in *oppositifolia*) :—
i. Buds somewhat oblong-globose with very broad, often pulvinate base, not prominently 3-lobed. Base of petioles not persistent nor greatly hardened :—
† L. not glaucous. Inflorescence sweet-smelling usually somewhat pubescent. L. all opp. more or less oblong. Tubers direct from rootstock. Unarmed . 2. *oppositifolia*.
†† L. glaucous beneath, opp. and alternate. Inflor. glabrous. Tubers at the ends of long fleshy fibres :—
Usually prickly below. L. pale glaucous beneath, nerves not scalariform. Fls. sickly smelling. Petals fleshy . . 3. *glabra*.
Unarmed. L. dark blue-green beneath with scalariform sec. n. Petals thin. Bulbils narrow or clavate, muricate . 4. *belophylla*.
ii. Buds globose, prominently 3-lobed. Base of petioles persistent hardening thickening and often spinous :—
L. rather coriaceous, orbicular, not glaucous, sec. n. not, or obscurely scalariform. Stamens central. Tubers fascicled direct from thickened base of stem . . . 5. *aculeata*. (*Wallichii*).
2. Spikes zigzag with a globose flower at each angle. Stems regularly angled or alate :—
Wild species, slender stems angled not alate, unarmed. L. lanceolate to ovate. Bulbils 0. Climbs left to right . . . . . 6. *Hamiltonii*.
Cultivated only. Stout stems 4-angled or 4-more alate. L. very broadly ovate. Bulbils large . . . . . 7. *alata*.
B. Sepals linear. Petals linear tapering. Spikes slender drooping 1–3·5″ or more long. Rhizome or tuber large and subglobose. Bulbils frequent, tubercled . . . . . 8. *bulbifera*.
II. Leaves some or all digitately 3–5-foliolate. Fls. often shortly pedicelled :—
A. Stamens 6 perfect. L. 3-foliolate, lflts. large (3–12″) 9. *dæmona*.
B. Stamens 3 perfect and 3 staminodes. L. 3–5-foliolate or upper simple :—
L. softly white-tomentose beneath. Staminodes and st. nearly as long as sepals . . . 10. *tomentosa*.
L. glabrous to tomentose, but not softly tomentose. Staminodes and stamens much shorter than sepals 11. *pentaphylla*.
C. Doubtful species. L. 6-foliolate. Lflts. large . *Kalka-pershadi* (p. 1124).

Key (B.) to Female Plants.

I. Leaves all simple. Spp. 1–8 :—
A. Sepals not linear. Capsule broader than long, seeds winged all round (not seen in *alata*). Spp. 1–7:—

1. Stems not alate nor regularly angled. Fem. perianth not attaining ·06″ (exc. *aculeata* which reaches ·07″) :—
   a. Whole plant more or less pubescent or tomentose. Ovary tomentose, capsule not quite glabrous . . . . . 1. *anguina*.
   b. Whole plant glabrous, or somewhat pubescent in *oppositifolia* and then ovary nearly glabrous :—
      i. Petiole-bases not persistent and woody or aculeate. L. mostly opposite. Fem. per. under ·06″ :—
         † Rhachis of inflor. often pubescent. L. not glaucous. Ovary and young capsule with short thick beak below the perianth 2. *oppositifolia*.
         †† Leaves glaucous beneath. All parts glabrous :—
            Usually prickly below. L. pale glaucous beneath. Perianth quite sessile on the ovary and capsule . . . . . 3. *glabra*.
            Unarmed. L. dark-glaucous beneath. Ovary and capsule with a short thick beak . . . . . 4. *belophylla*.
      ii. Petiole bases persistent enlarged and often aculeate. L. mostly alternate. Perianth quite sessile attaining ·07″ in young fruit . 5. *aculeata* (*Wallichii*).

2. Stems alate or regularly angled. Fem. perianth attaining ·1–·12″ in length, thick and fleshy or coriaceous in young fruit. Ovary and young capsule beaked :—
   Stems regularly angled. L. lanceolate to ovate. Sepals dorsally keeled . . . . . 6. *Hamiltonii*.
   Stems sharply 4-angular or 4-more alate. L. broadly ovate. Sepals convex dorsally . . 7. *alata*.

B. Sepals linear. Capsule oblong. Seeds not winged all round. . . . . 8. *bulbifera*.

II. Leaves 3 digitately 3–5-foliolate, at least the lower. Capsules oblong :—
   A. L. 3-foliolate, lflts. with 3–5 costæ, large, attaining 12″ by 6″. Capsule 1·5–1·7″ long by ·7–·8″ . 9. *dæmona*.
   B. L. 3–5-rarely 6-foliolate or uppermost sometimes simple, lflts. mostly 1-costate, not exceeding 5·5″ by 2·5″. Capsule not exceeding 1″ by ·5″ :—
      L. softly white tomentose beneath, upper often 2-foliolate or entire simple. Capsule cuneately oblong . . . . . 10. *tomentosa*.
      L. glabrous to tomentose beneath, not as soft and dense as in *tomentosa*. Capsule not at all cuneate . 11. *pentaphylla*.
   C. Doubtful species. L. 6-foliolate. Lflts. 1-costate, up to 6″ by nearly 3″ . . . . . *Kalka-pershadi* (p. 1124).

1. D. anguina, *Roxb.* Kukuri, M.; Kukui-sanga, *Ho.*; Kosa-alu, *Or.*

Stems unarmed from a small woody rootstock, developing immediately from its base a straight cylindrical tuber 18″–2 ft. long which is often palmately branched. Branches densely pubescent. Leaves all opposite, pubescent even when old on the nerves beneath, very broadly ovate-cordate or suborbicular, upper ovate. Male spikes pubescent ·5–1·25″ long dense-fld., closely 1–3-nate on axillary or shortly panicled rhachises 2–4″ long or sometimes falsely whorled on long branches 12″ and more long, buds globose pubescent or tomentose. Fem. spikes densely pubescent, 2–4″ long, solitary axillary or

mostly in short axillary panicles 4–6″ in length. Capsules ·5″ long, excluding the short obconic base, and 1″ broad, depressed (subcordate) top and bottom, margin of wings thickened, rarely quite glabrous.

Common in the moister forests. Purneah! Chota Nagpur, all districts! Angul! Fl. Sept.-Nov. Fr. Dec.–Jan.

An easily recognized Yam from its pubescence and its potato-like axillary bulbils, which are 1–2″ across with a thin greenish or grey brown skin, without conspicuous eyes. The tuber is about ·5″ diam. at the neck and 1–1·5″ in middle covered with rootlets. Leaves attain 10″ by 10″, acute or acuminate, with a characteristic silvery appearance beneath, costæ 7 with obliquely transverse sec. n., raised beneath, upper surface dull. Petiole half to as long as blade, pubescent. M. sep. ·05″ long, broadly oblong or ovate-oblong obtuse, petals shorter ovate membranous, slightly imbricate in bud, glabrous or somewhat pubescent outside, membranous or somewhat mesially thickened. St. 6 perfect, small, adnate to tepals to half way up. Bract ovate acuminate reaching nearly half-way up flower, deflexed, base somewhat decurrent on rhachis, pubescent. Fem. ovary densely pubescent or tomentose, not at all beaked, perianth ·05″ long, both sepals and petals much thickened at base with age, bearing a staminode on the callus, sep. broadly ovate rounded, petals rather smaller. Seed winged all round.

The tubers are eaten and are usually said to be good, but they are sometimes reported to have an offensive smell when cooked. The bulbils are also eaten.

2. **D. oppositifolia,** *L.* Pani-alu, *Or.*

Stems often purplish when young, swollen at the nodes, unarmed, sparingly puberulous, fleshy below and ending a few inches below the surface in a very small stock and a fascicle of tubers, ends of shoots pubescent. Leaves green and shining both sides, oblong to broadly elliptic, all opposite, cuspidate, mostly 2·5–3″ long with translucent dashes, 3–5-nerved, of which 3 unite in the tip, glabrous or nearly so, margin thinly cartilaginous. Petiole half as long as blade or much less. Male spikes dense ·5–·8″ long, subverticillate, false whorls on an axillary rhachis 1–4″ long or on a long terminal pendulous rhachis 1 ft. or more long which is thinly pubescent or hairy. Fls. sweet-scented ·08–·09″ yellow-green herbaceous on a very broad base on the deflexed suborbicular but cuspidate bract, sepals orbicular oblong concave 2·2 mm. or ·06″ long with pale margins, glabrous, petals obovate or obovate-oblong slightly fleshy 2 mm. or about ¾ths as long as sepals only. St. 6 erect. Pistillode of three green glands. Fem. with short beak between ovary and perianth. Capsule ·9″ long, 1·5″ wide, depressed base and apex.

Angul, in the moister forests! Fl. Aug–Sept. Fr. Nov.

In the Cent. Provinces List I united this with *D. glabra* on account of the difficulty in separating them in the herbarium from published descriptions, but I have now found the true *oppositifolia*, and the two species are absolutely distinct and easily recognized in the forest. The most conspicuous marks of *oppositifolia* in the forest are the very broad, sometimes almost parallel-sided and sub-truncate leaves with sudden cusp, never glaucous beneath and not cordate (or very slightly so in lowest leaves). Petioles relatively shorter than in *glabra*. Shoots and fem. rhachis pubescent (sometimes glabrous according to *F.B.I.*). Smell of flowers different.

Tubers proceeding direct from the fleshy end of the rootstock, several, with a narrow neck, then fusiform downwards, 6–8″ long. Cusp of leaves glandular when young; in addition to the 5 nerves there is sometimes a weak basal pair close to margin, base rounded or very obtuse, not cordate. Bract of male flower with the base decurrent on the rhachis both sides of the flower, under one-third as long as the flower and bracteole nearly as long as bract. Petals not as thick as in *glabra*. Anthers 6 perfect oblong, fil. as long as anther. Female rhachis solitary often 8″ long, or panicled; perianth ·03–·04″ long. Seeds orbicular with large wing all round.

The tubers are eaten, and are among the most esteemed of the yams among the Oriyas.

3. **D. glabra,** *Roxb.* Syn. D. nummularia, *Lamk.* in part; Unur-sanga, *K.*; Ato-sang, alto-sang, Baiyang, *S.*; Konta-alu, *Or.*

Stem quite glabrous with numerous prickles below or in rich moist soil sometimes quite unarmed, often ·3″ diam., swollen at the nodes and with swollen petiole-bases (but these not much hardened nor aculeate as in *Wallichii*), base woody passing into a nodose woody perennial superficial rhizome 3–4″ diam. from which proceed long stout fibres ending in the tubers. Leaves glaucous or nearly white beneath, opposite or lower alternate, variously shaped but lower, sometimes all, deeply cordate at the base or sagittate, those towards the inflorescence with the base generally straight or rounded, costæ 5–7 or even 9 on very broad leaves. Petiole long, from half as long to as long as the blade. Male spikes dense or lax, ·5–1·25″ long, opposite or verticillate on axillary rhachides 1–3·5″ long or in long terminal more or less leafless panicles, rhachis always quite glabrous. Flowers subglobose or oblong 1·5 mm. long, sep. ovate-oblong obtuse, gibbous at the base, petals obovate or oblanceolate, very thick. Stamens 6 perfect. Pistillode very minute. Fem. rhachis quite glabrous. Capsule ·6–·8″ long including the obconic base, 1–1·3″ wide, depressed at the apex.

One of the commonest of the yams in our area. Most frequent in open forest. Purneah! Gaya! Santal Parganas! All districts of Chota Nagpur, especially at about 2000 ft. though frequent also in the valleys of Saranda! Jaspur and Kochang, *Wood*! Puri! Angul, common! Kalahandi! No doubt therefore in all districts. Fl. Sept.–Nov. Fr. Nov.–March. Old male flowers may also be frequently found in a dry state as late as March and at this season the leaves turn yellow and fall.

The tubers are at the ends of long fleshy and stringy fibres which are 2 ft. long or even 3–4 ft. long; they are 5–12″ by 1–2″ in some cases; in others I have found them 1–2·5 ft. long by 2–3″ diam. more or less cylindrical, frequently curved. L. exceptionally suborbicular 7″ by 6″ or subsagittate 8·5″ by 3·5″, usually cuspidate, most commonly ovate and cordate, 5–9-nerved, sec. n. not scalariform between the costæ (as in *belophylla*), apex acuminate or cuspidate. Petiole half to as long as the blade or in very long leaves only one-third as long. Male spikes finally whorled direct on the main axis, the leaves of which gradually become smaller and bractiform. When in full flower with a strong rather unpleasant odour. Buds oblong. Base of the perianth-tube very broad and pulvinate on the upper side. Bracteole much shorter than the lanceolate acuminate bract which is about half as long as perianth, base of bract not decurrent on rhachis each side of the flower. Fem. perianth quite sessile on ovary, ·04″ long. Seeds winged all round.

No bulbils appear to be formed on this species.

There are two forms, one with much smaller laxer flowers than the others.

The tubers are largely eaten, but are not among the best of the yams. The Santals say that they are too sticky when boiled.

4. **D. belophylla,** *Voight.* Syn. D. glabra, *F.B.I.* (in part); Duri-sanga, Hasa-sanga, *K.*; Mutur-sang, *S.* (also San-kanda); Tanga-alu, *Khond.*; Geti or dura-sanga, *Kharw.*; Korondi-alu, *Or.*; Kunda-alu, Tara-kanda (in Angul); Malara (in Khurda).

Stems quite smooth, enlarged at the base into a small rhizome, bearing tubers at the ends of long fleshy fibres as in *D. glabra.* Leaves opposite and alternate, sap-green and dull above, glaucous beneath, both shape and size variable but usually ovate and deeply cordate

with well-marked close sub-parallel cross-nervules between the costæ beneath. Male spikes ·75–2″ long, lax-flowered, not whorled but unilaterally 2–3-nate on the rhachis, usually branched and frequently copiously panicled, the panicles axillary 4–6″ long, more rarely on long slender leafless branches. Flowers broadly oblong, base of perianth very broad and sessile, sep. nearly free oblong obtuse dotted and with scarious margins, pet. ell.-oblong nearly as long. Fem. with cylindrical beak between ovary and perianth. Capsule 1″ long by 1·5″ broad, often with the wings inclined upwards so that it is deeply cordate or retuse above, but not at base, sometimes apex truncate (except for the short beak).

Rocky valley forests, less common on the ridges and slopes. Singbhum! Palamau! Hazaribagh (also on Parasnath)! Puri! Angul! Narsingpur! Sambalpur! Fl. Sept.–Nov. Fr. Jan.–March.

Woody rootstock ·5–1″ diam. From this proceed the fleshy fibres which end in tubers 3–12″ long and up to 1·8″ diam. with grey skin and slender rootlets, roughly turbinate or cylindrical but often irregular in shape and flattened by wedging themselves between rocks. Bulbils linear or linear clavate, brown, somewhat muricate with incipient roots. L. sometimes attain 12″, as variable in shape as those of *D. glabra*, but even those on the flowering branches nearly always more or less cordate at base, costæ often 9, and secondary nerves distinctly scalariform, although some of them may be forked one end; cusp or acumen frequently curved. Petiole long slender, nearly always thickened and ridged or sub-alate in the upper portion by the decurrent costæ of the blade, base thickened and sometimes curled round a support. Fls. ·06″ long or rather less. Bract very short ovate cuspidate appearing deflexed and base decurrent upwards on the rhachis forming a shallow trough in which the bracteole and flower sit, apex not reaching half-way up the flower; petals much rounded, not thickened, sometimes 2-ridged within. St. on a short column about ⅓ths as long as petals, filaments rather longer than the 6 perfect broadly oblong anthers. Pistillode 3-gonous at top. Fem. spikes usually 1–3 in each axil, 3–5″ long with angular rhachis, glabrous, ovary long-beaked. Per. up to ·05″ long, sep. broadly ovate rounded, not keeled; pet. obovate nearly as long.

The most highly prized of our forest yams. I have found it excellent and very floury when cooked. But it is often impossible to obtain from being wedged in the fissures of rocks.

5. **D. Wallichii,** *H. f.* Syn. D. aculeata, *L.*; Kulu, Tungam-sanga, *K.*; Tunga-alu, Pita-alu, *Or.*

Stems very stout and woody, often thorny below and characterized by the hard thick bases of the articulate petioles which (the bases) are also frequently thorny. Tubers attached directly to the base of the stem without the intervention of long fibres or roots. Leaves all alternate or some opposite, rather coriaceous and shiny or dull, large, suborbicular or broadly ovate with a large broad basal sinus, usually cuspidate or caudate, nerves between the costæ rarely somewhat scalariform, petioles long. Male spikes ·5–1″ long, rather lax, 2–3-nate on the branches of a compound panicle 1·5–4″ long. Fl.-buds subglobose and 3-lobed, sometimes puberulous, fls. subglobose ·04–·05″ long and broad or sometimes broader when open, base broad adnate to base of bracteole. Fem. spikes panicled on an abbreviated lateral branch, often very short 1–2·5″ long, sometimes 10″ long, rhachis often sharply ridged, but not regularly angled as in *Hamiltonii*, ovary and fruit not at all beaked under the perianth. Ripe capsule ·6–·7″ long excluding the ·1″ obconic base, 1·2–1·5″ broad, depressed at the apex.

Singbhum, esp. in the Valley forests and on northern slopes, frequent! Hazaribagh! Puri! Angul! Fl. Oct.–Nov. Fr. Dec.–Feb.

Tubers numerous fascicled 2–3. ft long and 1–3″ diam. Young leaves shining, older shining or dull, sec. n. scarcely visible beneath and not continuous from one costa to the next, scarcely raised and reticulate, or sometimes sub-scalariform; costæ usually 9 of which lowest often forked, 3–5 reach the apex; translucent dots and dashes are visible by transmitted light; underside of blade somewhat paler than upper, but not glaucous. Petiole often as long as the blade, subterete, flattened on upper side near the apex, but not ridged with the decurrent leaf-nerves (though it sometimes appears ridged or striate when dry). Rhachis of panicles sometimes flattened. Bracts ovate half as long as the sepals or less, deflexed and base somewhat adnate and decurrent on the rhachis under the flower, bracteole subequal. M. sepals broadly oblong, slightly tapering to the rounded apex, concave; petals suborbicular little shorter; anthers large broad, as long as fil. Fem. sep. broadly ovate up to ·07″, rather thick, pet. obovate nearly as long, very thick, each with a small staminode in a depression near the centre. Young fruit pyriform in outline. Seeds winged all round, wing much dotted.

The tubers are eaten in the rainy season. They are said to require a large number of successive boilings to remove the acrid principle.

6. **D. Hamiltonii,** *Hook. f.* Beri-kanda, *Ho.*; Barujharia, *M.*; Piska-sang, *S.*

A climber with distinctly angled, sometimes subalate, and often twisted unarmed stems. Leaves closely resembling those of *D. belophylla*, but less blue-green, and when dry the cross-nervules are less scalariform, being joined up into sub-isodiametric areoles by other equally strong nervules, opposite or sub-opposite, lanceolate, ovate or deltoid or ovate-lanceolate with deeply cordate or sagittate base with rounded auricles, 4–7·5″ by 2–4·5″, uppermost smaller and narrower. Male inflorescence very characteristic, the spikes which are ·5–·75″ long having a markedly zigzag rhachis with a flower at each angle, spikes mostly ternate (1–4-nate) or subverticillate on long slender angled branches 6–15″ long. Fem. spikes axillary 1·5–9″ long, fls. much larger than in *belophylla* (at equal stages of development),* sepals very thick crescentic, concave inside and with a very thick keel outside, attaining ·1″ in length, petals thick oblong only $\frac{1}{2}$–$\frac{3}{4}$ths as long. Capsules very large 1″ long (excluding the short obconic base) and up to 1·6″ broad with distinctly margined wings.

In the forests, but rather local and locally abundant. Saitba Forest, Singbhum Ranchi, Horhap forest, common (also Hundrughagh, *Wood*, and without precise locality, *Clarke*!)! Manbhum, *Campbell*! Hazaribagh, on Parasnath, *Prain*, *Clarke*! Santal Parganas, very common about Silingi, Narjanj, Korcho Hill, etc.! Fl. Sept.–Oct. Fr. Dec.

From descriptions of the Kols the tubers resemble those of *D. belophylla*, but I have not personally dug them up. Bulbils 0. L. 7–9-nerved as in *belophylla*, with 5 reaching the apex and decurrent on petiole as in that species, apex suddenly acuminate or gradually tapering to a very acute tip; between the nerves are numerous translucent dashes. Petiole about half blade or as long, similar to that of *D. belophylla*. Male fl. yellow, ·05″ long, sep. ovate-oblong rounded concave, obscurely keeled, pet. smaller oblong, not thick; st. about half as long, 6 perfect.

Hooker in *F.B.I.* says "Capsule longer than broad, seeds laterally winged." This is not the case in my plant, which has capsules (in dried specimens) up to 1·75″ broad and only 1·1″ long, including the obconic pedicelliform base; moreover the seed (although the nucleus is somewhat eccentric and with one part, as is usual, narrowed to the point of attachment) is clearly winged all round. The ripe capsules are in fact the broadest of any of our species. My ♂ and ♀ specimens have been carefully matched in the field.

It climbs from left to right.

* The female perianth in both species continues to increase in size in young fruit.

7. **D. alata,** *L.* Merom-tuar sanga, *K.*; Sang, *S.*; Kham-alu. *Beng., Or.*

A very stout twiner with large tubers proceeding direct from the base of the stem which has sometimes scattered prickles below and on the petiole-bases, is compressed or strongly 4-angled at the base and 4–many-winged above. Leaves mostly opposite, glabrous, lower very broadly ovate cordate with a very broad sinus, often 8 by 6″ and suddenly cuspidate, 9-costate with lowest costa forked, transverse sec. n. sub-scalariform; upper leaves smaller and narrower, those on the flowering branches often lanceolate 3″ by 1·2″ or less, acuminate, 5-costate of which 3 reach apex, always somewhat cordate at base. Male spikes with zigzag winged rhachis ·4–·7″ long, 2–3-nate or sub-verticillate on axillary branches, one flower at each angle of the spike as in *Hamiltonii*. Fls. subglobose, ·05″, sep. ell.-oblong rounded and concave ·05″ long, pet. little shorter obovate, st. 6 perfect short, in central column around small pistillode. Fem. spikes 4–8″ long axillary solitary sometimes forming large brachiate panicles by suppression of upper leaves, young fruit shortly stoutly beaked and wings with thickened margins, sep. attain ·12″ long, thick concave boat-shaped but sharply convex rather than keeled outside, concave within, petals broadly obovate or subquadrate, very thick and fleshy.

This is the commonly cultivated yam of Chota Nagpur, and apparently occurs all over the province, but flowers have only been collected in Chota Nagpur, and I have not seen the ripe capsules. Fl. (and unripe capsules) Oct.–Dec. Not known wild.

It appears very close to *Hamiltonii* and chiefly distinguishable by the much stouter, often armed strongly angled or winged stems, larger broader coarser leaves and winged rhachis of male spikes. In my specimens the female has broad lamellate staminodes at base of petals, much more conspicuous than those of *Hamiltonii*, but I have examined too few specimens to make this a key character.

Prain (in *Bengal Plants*) gives several varieties, but these are from the shape and colour of the tubers only. Our plant has usually large irregularly clavate tubers with a narrow neck at the stem, white within and pinkish outside, and comes apparently under the variety *rubella* (syn. *D. rubella, Roxb.*) to which the Bengali name *Guraniya-alu* is given.

D. alata bears large geminate bulbils not seen in *Hamiltonii*, often many on special branches, mostly oblong brown with a tessellated or longitudinally cracked corky surface; they attain 3″ by 1–2″.

8. **D. bulbifera,** *L.* Syn. D. sativa, *L.*; Pisika, *Ho.*; Harad-bo, *M.*; Bengo-nari, *S.*; Pita-alu, *Or.*

Stems smooth, sometimes sub-alate, from a large brown subglobose rhizome covered with roots and prominent eyes not bearing other tubers. Leaves alternate, rarely opp., suborbicular or broadly ovate, abruptly caudate and usually deeply cordate. Male flowers green or purple in numerous long very slender axillary and panicled spikes 1–3·5″ long, sepals and petals linear. Fem. spikes slender, drooping, several fascicled at each axil, sepals and petals as in male. Capsule broadly oblong ·75″ by ·4–·5″, reflexed.

Common. Purneah! Santal Parg.! Throughout Chota Nagpur! Bonai, *Cooper*! Angul! No doubt throughout the province. Fl. Aug.–Sept. Fr. Nov.

A very distinct species. Bulbils common, axillary, roundish, brown with prominent numerous uniformly distributed tubercle-like eyes exactly like the rhizome on a small scale. Stem sometimes with 10–15 small crisped wings (var. *crispata, Prain*, syn. *D. crispata, Roxb.*). L. often 10″ long and broad, sometimes

more, smaller upwards, always alternate where I have noted them, sometimes opposite according to *F.B.I.*, costæ 7–11, with very distinct scalariform cross-nervules, sinus usually very wide, sometimes shallow. Petiole as long as or usually much shorter than blade. Male buds ovoid, fls. ·06–·1″ long or more, variable, petals narrower than the sepals, more tapering. St. very small, 6 perfect, not ⅓th as long as petals. Bract half to ¾ths as long as flower with filiform acumen. Seeds with an oblong wing above.

The rhizomes are said to be very acrid, but sometimes eaten in times of famine after much preparation. They lie quite close to the surface.

9. **D. dæmona,** *Roxb.* Kolo, *S.*; Taina, *Ghatw.*; Baichandi (in Cent. Prov.).

A strong twiner with stems often ·25″ diam. with few small weak prickles, young tomentose. Leaves large 3-foliolate, long-petioled, lflts. of lower leaves often 8″ by 4″, and attaining 12″ by 6″, central one elliptic or obovate suddenly acuminate 3–5-costate, or those on the flowering branches only 2·5″ by 1·4″ with rounded suddenly apiculate apex, lateral leaflets very oblique; petiolules of lower lflts. ·5–·75″ pubescent. Male fls. in very dense short-oblong spikes ·25–·3″ long in long narrow axillary pubescent panicles 6–8″ long. Fem. spikes usually 2-nate, simple pubescent or tomentose, 8–12″ long. Capsule large oblong 1·5–1·75″ long and ·7–·8″ broad.

Purneah! Santal Parg.! Hazaribagh (Koderma Forest)! Manbhum, *Camp.*! Angul! Sambalpur! Probably in all the damper forests. Fl. June-July. Fr. Aug.-Sept.

Tuber subglobose or irregular, up to 12″ diam., marked with eyes and covered with root-fibres. Petioles of lower leaves 6–12″, those on the branchlets exceeding the leaflets. L. more or less permanently pubescent on the nerves. M. pedicels of spikes pubescent; bracts under the fls. very small, orbicular with broad base, concave, pubescent, ·05–·06″ diam. Petals oblong-obovate incurved, ·04–·05″ long, and about twice as long as the rounded membranous sepals. Anthers 6 perfect, minute, globose-oblong, filaments hardly any. Fem. bracts lanceolate ·1–·12″ long. Ovary tomentose oblong ·15″ rapidly enlarging.

According to *Roxburgh* the root is dreadfully nauseous even after boiling, and according to the Gonds it is sometimes eaten after frequent washings, while it is also said to be made up into sweetmeats in the Central Provinces (possibly through confusion with *pentaphylla* ?).

10. **D. tomentosa,** *Heyne.*

Stems and leaves beneath with a matted tomentum and leaves thinly tomentose or hairy above. Leaflets 3 or 5–6, central obovate or elliptic, shortly cuspidate or shortly caudate, 2·5–4·5″ long, lateral very gibbous at the base, sec. n. 2–3 each side. Petioles up to 4″, petiolules ·1″. Inflorescence white-tomentose. Bracts ·06″ long. Male fls. ·06″ on pedicels ·02–·04″ long in panicled usually ternate spikes ·7–1″ long. Female racemes sometimes simple up to 8″ long or with branches 3–5″ long. Capsules at first tomentose, finally glabrous, somewhat cuneately oblong ·8″ by ·4″ or sometimes ¾ths as broad as long.

Angul, *Lace*!

The stems are more or less prickly and hairy. Upper leaves sometimes 2-foliolate, 2–3-lobed or entire. It is doubtful whether this species is more than a variety of *D. pentaphylla*, but it is chiefly South Indian.

11. **D. pentaphylla,** *L.* Baiom-sanga, Itulad-sanga, *K.*; Haseor, *M.*; Khania-kanda, *Kharw.*; Karba, Koraba-alu, *Or.*; Kanta-alu, *Beng.*

A much more slender climber than *D. dæmona*, more or less prickly

below, with 3–5-foliolate leaves, glabrous or pubescent beneath. Leaflets of lower leaves attain 5·5″ by 2–2·5″, rarely larger, centre ones obovate or elliptic suddenly cuspidate or acuminate, cuneate towards base, 1-costate only, lateral leaflets sometimes 3-costate, but the lateral costæ from the midrib. Male spikes ·4–1·5″ long, 1–2-nate in long axillary racemes and sometimes terminally panicled, or the axillary racemes sometimes branched. Female spikes long and solitary or 2-nate rarely panicled, 2–4″. Capsule large oblong 1″ by ·5″ deflexed.

Frequent. Purneah, *Ham.*! Monghyr, *Ham.* (*Wall*, No. 5098). Ranchi, especially above 2000 ft.! Palamau! Hazaribagh (Koderma Forest)! Singbhum! Angul! Fl. r.s.–c.s. Fr. c.s.–h.s. Probably in all districts.

There are probably two distinct species included under this name. One has elongate obpyriform bulbils, the other with larger roundish corky and tesselate bulbils; this latter is much more pubescent or hairy than the former; but as the bulbils are not attached in the herbarium, I cannot with certainty correlate their form with other characters. *Prain* and *Burkill* (*Journ. of Asiatic Soc.*) have recorded two varieties according as the plant is silvery-grey with tuber white and soft (var. *Linnæi*) or rusty red with root puce-coloured and stringy (var. *Rumphii*), but they do not give the shape of the bulbils in these two varieties, nor have I seen any description of other characters.

The tubers are oblong or clavate, proceeding direct from the base of the aërial stem and thickening downwards. The following very distinct varieties occur in our area :—

Var. **communis,** *Burkill*, m.s. ?

Prickly. Lflts. mostly 5-foliolate or 3–5-foliolate, up to 4–5″ by 2″ mostly suddenly cuspidate, blade thinly hairy, but petiolules densely closely rusty-pubescent. Male fl. shortly pedicelled above the bract, bracts rather large, the bract and bracteole together deltoid in outline with very broad partly amplexicaul base ·08″ wide, ·06–·07″ long, pubescent, sepals ·04″ long pubescent, petals subequal more oblong, pistillode far exceeding the stamens. Fem. spikes 2–3″ in flower, sometimes panicled, 5″ excluding the slender peduncle in fruit; bracts ·08″ long, lanceolate, ovary ·15″ densely tomentose, sepals ·08″. Fruit ·7″ by ·35″ to 1″ by ·5″.

Ranchi! Singbhum!

Var. **cyathiformis.**

Leaves mostly or all 3-foliolate, lateral relatively much broader than in last variety, semi-ovate, central broadly elliptic, less suddenly acuminate, sparsely hairy. Pedicels ·03″ long below the bract, flower quite sessile in the bract and bracteole which are glabrous and form a nearly complete cupule round the flower, both orbicular concave, bract with a minute almost filiform sudden cusp. Sep. triangular or lanceolate, petals more ovate, both thickened below and glabrous or nearly so. Stamens longer than the pistillode.

The bulbils are yet small and globose. The racemes laxer than in first variety.

Ranchi! Angul!

The tubers of *D. pentaphylla* are eaten, but that of our second variety is said not to be very good.

D. Kalka-pershadi, *Burkill* (in *Kew Herb.*), is, I think, a form of *D. pentaphylla* with 6 very large leaflets attaining 5″ by nearly 3″ and with 8 sec. nerves. *D. pentaphylla* has, however, leaflets often as large, and up to 8 sec. nerves in such larger leaflets. The tubers are short cylindrical up to 1 ft. long, densely covered with roots and the stems sparingly prickly. It is apparently considered to be a hybrid between *pentaphylla* and *tomentosa*, but does not appear to me to have anything to do with *tomentosa* (except in so far as *pentaphylla* passes into that species).

Ranchi (Biru), *Cardon*!

FAM. 153. BURMANNIACEÆ.

Herbs with linear, chiefly radical leaves or leaves reduced to scales. Flowers regular, rarely zygomorphic, 2-sexual, spicate or racemed and

unilateral, sometimes solitary on the rhachis, more usually sympodially spicate or racemose on the branches of forked cymes. Perianth adnate to the ovary and produced above it into a persistent 6-, rarely 3-lobed gamophyllous often angled tube, lobes valvate. Anthers 3 or 6, 2-celled, sessile on the perianth. Ovary inferior 3-celled or 1-celled with 3 parietal placentas; style 1, short, stigmas various. Ovules many, small, anatropous, with 2 integuments. Fruit capsular, sometimes with transverse or irregular dehiscence. Seeds minute, testa reticulate, often produced. Albumen few-celled only. Embryo very minute.

1. BURMANNIA, *L.*

Annual herbs, leaves often inconspicuous. Flowers solitary or few or more on the branches of a forked cyme. Perianth tube winged or angled, 3-lobed. Petals smaller or 0. Anthers 3, sessile or subsessile, cells short separated by a broad connective, dorsally crested, dehiscence transverse. Ovary 3-celled, style 3-lobed.

1. B. cœlestis, *Don.*

A very pretty little plant with erect very slender or filiform strict stems nearly leafless except towards the base, 2–12″ high, terminating in a solitary flower, or 2–5 flowers in luxuriant specimens. Flowers cobalt blue ·3–·5″ long, oblong-elliptic or almost orbicular in outline, prominently winged.

In wet grassy places. Purneah, common! Ranchi, 2000–3000 ft.! Singbhum, usually above 1000 ft.! Hazaribagh (Giridih), *Clarke*! Behar and Tirhut, *Bengal Plants*. Probably in all districts. Fl., Fr. c.s.

Leaves usually clustered near the root, ·2–·7″, lanceolate or subulate with a filiform tip, cauline few usually narrower. Bracts similar to the leaves.

FAM. 154. IRIDACEÆ.

Herbs, often with rhizomatous tuberous or bulbous rootstocks and usually narrow distichous or equitant leaves. Flowers 2-sexual in terminal 1–many-flowered inflorescence, 2-bracteate, regular or zygomorphic. Perianth superior, with 2 different or usually similar and petaloid, 3-merous whorls usually with long or short tube at base, tepals imbricating. Stamens always 3 (belonging to the outer whorl of the normal Liliflorous type), free or connate, epigynous or adnate to the outer perianth whorl, anthers often narrow, basifixed, extrorse. Ovary 3-celled. Style-branches usually branched or divided above, rarely simple, frequently more or less petaloid or expanded. Ovules many, 2-seriate axile anatropous. Fruit a 3-gonous, 3-celled, loculicidal capsule. Seeds many, roundish or angled by pressure, with thick or thin testa. Embryo immersed in the albumen, short, cylindric.

There are no wild species in our area, but several beautiful garden or verandah plants are commonly cultivated, such as *Cipura*, *Freesia*, etc., and the following is included in the *F.B.I.*

1. BELAMCANDA, *Adams.*

1. B. chinensis, *Leman.* Syn. Pardanthus chinensis, *Ker.*; Leopard-flower.

A free-growing plant with iris-like equitant leaves from a creeping

rootstock. Flowers tawny-red or orange-red, black or scarlet-spotted, in a branched spathaceous panicle about 2–2·5 ft. high, regular with very short perianth-tube and oblong spreading subequal segments. Stamens inserted at the base of the perianth, filaments filiform. Ovary obovoid, tips of style-arms reniform. Capsule obovoid, membranous.

Very common in gardens in all districts ! Fl. r.s. Native of China, and doubtfully wild in the Lower Himalayas.

SERIES.—SCITAMINEÆ.

FAM. 155. MUSACEÆ.

Large or gigantic herbs with a short or long pseudostem formed of the stout convolute leaf-sheaths often from a rhizome, or small trees with a true stem marked with leaf-scars. Leaf blade very large, penniveined, petioled above the sheath. Flowers zygomorphic, often large but inconspicuous, or sometimes showy, the inflorescence (of simple or compound spikes) often very conspicuous by large brilliantly coloured bracts and spathes. Outer and inner perianth segments usually petaloid, free or variously united. Fertile stamens 5, very rarely 6, the posterior usually replaced by a staminode, anthers linear 2-celled. Ovary inferior 3-celled. Style free often 3–6-lobed. Ovules 1–many in each cell. Fruit baccate or capsular. Seeds, often arilled, with straight embryo in a mealy perisperm.

The flowers are sometimes functionally 1-sexual. In the male the ovary is almost entirely converted into a nectary. Glands occur in the ovarian septa as in the Marantaceæ.

I. Leaves spirally arranged. Sepals connate and also adnate to the corolla. Stem of convolute sheaths . . . 1. *Musa.*
II. Leaves 2-farious. Sepals free. True stem often present :—
Petals free . . . . . 2. *Ravenala.*
Two lateral petals connate . . . . . *Strelitzia* (p. 1128.)

1. MUSA, *L.* Banana; Plantain.

Large or gigantic rhizomatous (in our species) herbs, often arboreous in form with a stem composed of the convolute leaf-sheaths. Leaves very large, spirally arranged and forming a compact crown, lateral nerves spreading. Flowers mostly 1-sexual, not brightly coloured, in the axils of large, usually coloured, closely imbricate spiral bracts of a stout spike which arises from the rhizome and is pushed up through the centre of the pseudostem until it emerges from the top ; flowers at the base of the spike usually female or 2-sexual, top of spike sometimes ending in a cone of flowerless bracts. Sepals and 2 of the petals usually connate into a 3–5-cleft or -toothed tube, posterior petal free and usually much shorter than the rest. Stamens 5 fertile (6 in *M. ensete* an African species), the 6th obsolete or a staminode. Ovary 3-celled with many ovules and seeds in the wild plants (often suppressed in cultivated fruits). Fruit baccate, elongate, crowned with the remains of the flower.

Spike decurved in flower, bracts ovate purple, very many . . 1. *sapientum.*
Spike erect in flower. Bracts oblong, a bright rose, few . . 2. *ornata.*

1. M. sapientum, *L.* Khela, *Vern.*

Pseudostem 8–15 ft. with oblong leaves 4–6 ft. long. Spike soon decurved and finally drooping, 3 ft. or more long with very large ovate deep red or dull purplish, more or less pruinose bracts, lower 6–8″ long and deciduous, upper often forming a club. Lower bracts with numerous 2-seriate female or hermaphrodite greenish or yellowish flowers about 1·5″ long, above these the bracts contain male flowers only or the terminal ones are empty. Connate part of perianth 5-toothed, free petal about half as long. Fruit oblong, 3-gonous in the wild form, about 3″ long with very astringent scanty flesh and numerous black or brownish black rugose seeds.

Wild in deep rocky ravines in Singbhum and in the Rajmahal Hills! On northern slopes of Parasnath! Ravines in Angul! The locality, provided it is damp, is a good deal determined by its inaccessibility to wild elephants. Fl. March-July. Fr. r.s. and c.s.

There are very numerous varieties in cultivation and the best of these have no trace of seeds. They are sometimes divided into *M. sapientum* proper, the banana, of which the fruit is edible uncooked, and *M. paradisiaca, L.*, the plantain, of which the fruit is only eaten cooked, and is larger than in *sapientum*. They are increased by separating the rhizome with its new shoots. The old stems die after flowering.

2. M. ornata, *Roxb.* Syn. M. rosacea, *F.B.I.*

A stout herb 3–5 ft. high with leaves about 4·5 ft. by 1 ft. and petiole 1–2 ft. Spike perfectly erect 15–18″ from the base of the linear rose-coloured spathe, the tip of which is foliaceous; bracts bright rose-colour or pink, oblong-lanc. to ovate-oblong, 3–5″ long, only the lowest 4–5 fertile and each bearing 3–4 flowers. Fruits 2–4 in a cluster, trapezoidal in section.

A very beautiful plant growing in deep black mud alongside sluggish streams in the wildest Singbhum valleys! Fl. May–July. The plant is said to be cultivated for ornament and the *F.B.I.* says that the spike droops in the cultivated form (!).

Rhizome producing new shoots as in the common plantain. Rhachis of the inflorescence quite glabrous in our plant (but I have found a very similar-looking *Musa* in Upper Burmah, in which the rhachis is densely pubescent and fls. 5–8 in each bract). Perianth 1·5″, greenish below, yellow upwards, 5-toothed, free petal as long, colourless.

2. RAVENALA, *Adans.*

Stems often tall and slender, bearing a terminal crown of large long-petioled, markedly distichous leaves, spreading like a fan. Flowers large in short axillary racemes from the axils of large distichous cymbiform bracts. Sepals 3 free similar. Petals 3 free, 3 lateral like the sepals. median shorter. Fertile stamens 5 or 6 with linear anthers sometimes exceeding the filaments. Ovary 3-celled. Style 6-toothed at the tip. Fruit a long loculicidal many-seeded capsule. Seed with a large, intensely coloured, fimbriate aril.

1. R. Madagascariensis, *Sonnerat.* The Traveller's Tree.

A very striking and picturesque, easily recognized tree with a fan-shaped crown of lanceolate-oblong leaves with long petioles, somewhat resembling those of the plantain.

Native of Madagascar and Reunion. Often seen in large gardens.

Called Traveller's Tree from the large amount of water collected in the leaf-sheaths which can be drunk.

Strelitzia reginæ, *Ait.*, and **S. augusta**, *Thunb.*, are more rarely seen. Their leaves are similarly arranged on short or slender stems and their flowers often brilliantly coloured, in *S. reginæ* orange-coloured with 2 deep blue or purple petals. *S. augusta* is sometimes called the white-flowered bird-of-Paradise flower.

FAM. 156. ZINGIBERACEÆ.

Perennial herbs, often very large, usually with fleshy rhizomes and thick roots. Stem well developed or composed of the leaf-sheaths only. Scape sometimes distinct from the leaves. Leaf-sheaths usually with a ligule. Inflorescence various. Flowers moderate-sized or large, usually zygomorphic. Perianth superior, differentiated into 3-merous calyx and corolla. Calyx more or less tubular or spathaceous, generally shortly 3-toothed, often colourless. Corolla usually on an elongated quasi-hypanthium (corolla-tube) bearing the 3 petals (of which the dorsal is usually somewhat cucullate or different) and also the androecium. Stamen only one perfect, being the dorsal one of an inner whorl, of which the two anterior members are combined into a petaloid lip with its hinder margins embracing the fertile stamen. Besides these are usually present the two obliquely posterior members of the (theoretical) outer staminal whorl, *lateral staminodes*, which are sometimes reduced to teeth or are petaloid or absent, the third (anterior) member of the outer whorl being always absent. Connective of fertile stamen often produced or appendaged. Ovary 3-celled with axile placentation, more rarely 1-celled with 3 parietal placentæ. Style very long and delicate often placed in a groove of the stamen, and the usually funnel-shaped ciliolate stigma projecting beyond the anther-cells. Ovules many. Fruit usually capsular but often tardily dehiscent, sometimes indehiscent or irregularly breaking up. Seeds often arilled, with large mealy perisperm enclosing smaller endosperm. Embryo straight, cylindric.

The plants of this family are often aromatic when bruised.

I. Ovary 1-celled :—
  Herbs under 3 ft. Flowers not large, yellow . . . 1. *Globba.*

II. Ovary 3-celled :—
  A. Lateral staminodes well-developed, usually free, broad (exc. sometimes in 5) :—
    1. Inflorescence a dense bracteate spike crowned with a crest of coloured barren bracts (coma) . . . 2. *Curcuma.*
    2. Inflorescence without a coma of barren bracts :—
      a. Connective very broad or crested. Flowers not in dense spikes, sometimes 1–2 only :—
        Connective broad, not crested . . . . . 3. *Gastrochilus.*
        Connective crested . . . . . 4. *Kæmpferia.*
      b. Connective very narrow, not crested. Flowers in many-flowered usually dense spikes . . . 5. *Hedychium.*
  B. Lateral staminodes very small, or narrow and adnate to lip, or 0. (In *Zingiber* spp. the broad lateral lobes of the lip might be taken for lateral staminodes) :—
    1. Flowers in dense, often strobilate spikes with imbricate bracts :—
      Inflor. distinct from leafy stem. Connective crested or not produced. . . . . 6. *Amomum.*
      Inflor. usually distinct from leafy stem. Connective produced into a long beak . . . . . 7. *Zingiber.*
      Inflor. terminating the leafy stem. Filament petaloid 8. *Costus.*
    2. Flowers in loose spikes or panicles terminating the leafy stem . . . . . 9. *Alpinia.*

1. GLOBBA, *L.*

Herbs with stem erect from a creeping rhizome. Leaves distichous, mostly narrow. Flowers yellow in spikes or panicles, the buds sometimes replaced by bulbils. Calyx funnel-shaped, 3-lobed. Corolla-tube slender, exceeding the calyx, with ovate subequal lobes usually finally reflexed. Lateral staminodes petaloid, usually finally reflexed with the corolla, lip deflexed, with base usually decurrent upwards on the column; filament with 2 dorsal appendages, long, incurved, anther oblong, connective winged, spurred or muticous, produced beyond the cells. Ovary 1-celled with 3 parietal placentæ or base 3-celled; style filiform placed in a groove of the filament, stigma turbinate. Capsule globose fleshy, tardily dehiscent. Seeds small, often pubescent, ovoid with a small white lacerate aril.

A. Anther neither spurred nor winged. Bracts deciduous :—
  1. Lip not cleft half way into narrow lobes :—
    Cor.-tube 3 times length of calyx. Lip longer than petals, petals longer than staminodes, lip 2-fid. Leaves pubescent or glabrescent beneath . . . . . 1. *racemosa.*
    Cor.-tube twice length of calyx. Lip, petals and staminodes all equal in length. Lip 2-lobed. Leaves glabrous beneath. Ovary verrucose . . . . . 2. *orixensis.*
  2. Lip cleft nearly three-fourths way down into 2 linear lobes much longer than petals. Leaves finely pubescent beneath. Ovary smooth . . . . . 3. *ophioglossa.*
B. Anther with spreading 2-fid wings. Bracts persistent . . 4. *bulbifera.*

1. G. racemosa, *Smith.*

Height 1–3 ft., stems inclined or erect, with oblong or elliptic-oblong (or lowest somewhat ovate-oblong) leaves attaining 11″ by 3·5″, mostly 7–8″ long, ending in a twisted tail ·8–1″ long, softly pubescent beneath, becoming glabrescent in age. Panicle narrow, lowest branches 3-fid. Flowers bright-yellow, whole length (with stamen) 1·5″. Ovary smooth or verrucose ·1″. Calyx ·28″, corolla-tube ·8″, puberulous. Petals broadly ovate, median hooded, shortly horned, ·2″, lateral ovate, apiculate, ·2″, often twice the length of the oblong-ovate staminodes (but equal according to *Baker* in *F.B.I.*). Lip ·44″ including its long adnate base, longer than the petals when all the perianth segments and staminodes are reflexed (soon after opening of the flowers), 2-fid with lanceolate lobes, the two halves reduplicate, cleft about one-fourth way down, all minutely gland-dotted (as in other species). Capsule ·5″, smooth or verrucose.

Shady places in Chota Nagpur, over 2000 ft. elev. Ranchi! Parasnath! Fl. Aug.–Sept.

I include this under *racemosa* though the shortness of the staminodes is not according to description. The ovary being sometimes verrucose would cause it to be placed under *orixensis* by some botanists.

Panicle sometimes pubescent, bracts very caducous, ·4″, narrowly oblong.

2. G. orixensis, *Roxb.*

Habit of preceding. Leaves glabrous beneath, 8–10″ by 2–4″ (*fide Roxb.*), similar to those of *racemosa*. Panicles similar. Flowers orange-yellow, smaller than in *racemosa*. Ovary verrucose. Calyx ·15″ only and corolla-tube only about twice the calyx. Petals broadly ovate, longer than the staminodes (equal according to *Baker*).

Lip obovate as long as the reflexed petals, shallowly 2-lobed. Capsule verrucose. Seeds tomentose.

Chota Nagpur, frequent (if all the specimens so assigned to it in the *Cal. Herb.* are correctly named, but several are now indeterminable)! Rajmahal Hills, *Kurz*! Probably Orissa (Northern Circars is the country of origin of the type). Fl. r.s.

Schumann described the corolla-lobes as lanceolate. The species is very close to *racemosa* and many plants appear to show intermediate characters.

3. G. ophioglossa, *Wight.*

Leaves pubescent beneath, similar in shape to the last two. Panicles with the lower branches bearing 4–6 flowers, the lowest often bulbiferous. Calyx ·12″ long. Corolla pale-yellow with the tube three times the calyx, lobes ovate acute. Lip twice the length of the corolla, deeply 2-fid to about three-quarters the way down, segments very narrow. Capsule smooth.

Chota Nagpur, *Cal. Herb.*; but I do not think that the specimens (two only) so named are either of them Wight's plant and are probably *racemosa*.

The above is a description of Wight's plant, not of the *Calcutta Herbarium* specimens.

4. G. bulbifera, *Roxb.*

A more slender plant than *G. racemosa*, 1–2 ft. high. Leaves much smaller 3–5″ by 1″ to 4·5″ by 2″ or 6 by 2″, lanceolate to elliptic ending in a long straight or slightly twisted tail, shortly pubescent beneath. Flowers yellow in the axils of large folded sub-persistent bracts ·6″ long in simple spikes 2–4″ long, the lower (sometimes all) bracts usually bearing a solitary bulbil in place of a flower. Fls. 1–1·2″ long including the stamen. Filament strongly arched as in the others, anther with 2 large spreading lateral wings cut nearly to the base into 2 triangular segments, larger ·15″ long.

Common in shady places, damp banks, etc., in the forests. Throughout Chota Nagpur! Has often been collected on Parasnath. Fl. Aug.–Oct.

Stems often inclined with spreading distichous leaves, the lowest sheath often purple. Bracts (when opened) rhomboid-ovate with broad base and very acute tip. Bulbils erect, globose-oblong, ·15″ long. Petals and staminodes reflexed. Dorsal petal boat-shaped ·25″, lateral similar, rather smaller. Lat. staminodes petaloid oblong, ·45″. Lip dependent from the column, ·35″ long, oblong but gradually wider towards tip (oblong-trapezoid) with 2 oblique lobes and base 2-clawed. Ovary often 3-locular at base. Capsule rugose. Seeds globose, pale-brown, pubescent, seated on a cupular-lobed aril.

2. CURCUMA, *L.*

Herbs with rhizomatous and tuberous roots and usually with accessory tubers developed at the ends of long fleshy roots. Stem, if any, composed of the convolute leaf-sheaths. Leaves usually elliptic or oblong and often very large. Flowers in dense bracteate spikes with the peduncle clothed with appressed bracts and spike terminating in a crown of barren coloured bracts (coma), floriferous bracts adnate in their lower part and enclosing several flowers opening in succession, each with its proper membranous bract wrapped round the ovary and short cylindrical, usually minutely toothed calyx. Corolla-tube narrow and terete below, ventricose above, bearing 3 petals, of which the median is larger and hooded. Lateral staminodes petaloid, broad, connate with the short broad filament, anther

reclinate often with 2 long spurs, and the connective behind with a minute ridge. Stigma capitate, with a slightly 2-lobed gibbosity above and a transversely oblong stigmatic surface below the gibbosity. Capsule globose, membranous, finally 3-valved. Seeds ovoid or oblong, usually arilled.

The subterranean parts of the plant normally consist of a short, more or less conical stock ("bulb"), which forms the base of the year's shoot and the apex marked with the rings of the decayed leaf-sheaths in its second year (Fig. 8 of the *Zingiberaceæ* in the *Nat. Pflanz. Fam.* erroneously shows the "bulb" lying on its side!). From the bulb proceeds a branched or unbranched short or elongate rhizome or rhizomes ("rhizome" of my descriptions, "sessile" or "palmate tubers" of the *F.B.I.*) which bear further bulbs, or such rhizomes may be apparently absent, the whole of the short lateral rhizome at once assuming the form of the new bulb and giving rise to the new shoot. From the middle and lower parts of the bulb issue numerous roots and long fleshy fibres which bear at their ends turbinate fleshy tubers ("stipitate tubers" of *F.B.I.*, "tubers" of my descriptions, *da* or *daka* of the Kols); these do not give rise to new plants and are merely stores of nutriment. Whereas the rhizomes and their special modifications, the bulbs, are often very aromatic and deeply coloured, the tubers are usually white or watery, very slightly or not aromatic, and often yield a form of starch or arrowroot.

I. Flower-spikes lateral to the leafy tuft or distinct and usually developed before the leaves appear. (In 2 and 3 vernal spikes are lateral, and æstival spikes central):—
  A. Rhizomes small or 0 the new bulb developing close to the side of the old one. Fls. far exserted. Coma red or pink:—
    1. Ovary villous or hirsute. Midrib of leaf green:—
      Leaves narrowly lanceolate, gradually acuminate, smooth . . . . . 1. *angustifolia.*
      Leaves elliptic, suddenly caudate, plicate. . . 2. *sulcata.*
    2. Ovary glabrous. Leaves broadly lanceolate with petiole and midrib deep red . . . . 3. *rubescens.*
  B. Rhizome well-developed and branched. Leaves green sub-plicate. Flowers not exserted:—
    Leaves glabrous. Petals ovate acuminate . . . 4. *leucorhiza.*
    Leaves pubescent beneath. Petals oblong obtuse. . 5. *aromatica.*
  C. Rhizome well-developed. Leaves with a deep purple cloud down their centre. Fls. rather shorter than their bracts:—
    Rhizomes yellow or straw-coloured within . . . 6. *zedoaria.*
    Rhizomes bluish-grey within . . . . . 7. *cæsia.*
II. Flower-spikes always rising from the centre of the leaf-tuft. Coma usually pale pink, white or yellow and its bracts few (see also 2 and 3 above):—
  Rhizome pale yellow. Coma usually pale pink. Calyx puberulous, ovary villous . . . . . 8. *amada.*
  Rhizome orange-yellow. Coma often colourless and proper bracts often barren. Calyx with few fine hairs. Ovary hairy at the tip only . . . . . 9. *longa.*
  Rhizome poorly developed. All bracts a deep orange-yellow . . . . . 10 *reclinata.*

1. C. angustifolia, *Roxb.* Paro, *K.*; Tikari, Tikur, *H.*

Leaves appearing after the flowers or very young at the time of flowering, arising laterally from base of the rootstock and stem hardly any composed of the convolute leaf-sheaths. Leaves few, narrowly lanceolate to elliptic-lanceolate 1–3 ft. long (including sheath and petiole) by 2·5–4·5″ wide, gradually acuminate to a very fine point. Petiole with sheath 6–12″. Plant in flower about 12″ only from the rhizome, peduncle lateral clothed with puberulous, often coloured, leaf-sheaths. Spike 3–5″ with the lower flower-bracts

1·3″, the free part about two-thirds the whole length, tip rounded. Coma small with only 5–9 oblong, usually deep magenta glabrous or minutely pubescent bracts. Flowers far-exserted (for ·5–·7″), 1·5″ long. Ovary villous, calyx ·6″, puberulous, colourless with 3 rounded lobes, deeply split dorsally. Petals oblong; dorsal a little longer, somewhat pubescent, the shortly hooded tip not apiculate, but somewhat acute. Lip longer than the petals, yellow, rounded deeply 2-fid or emarginate. Sometimes the flowers are a handsome reddish yellow in all parts. Lateral staminodes yellow, free portion ·5″ long, oblong, slightly exceeding the petals. Anther puberulous reclinate with long basal spurs and short basal knobs.

A common forest species though only collected from our area in the forests of Chota Nagpur! Fl. May and leaves appear in June, but *Roxburgh* says that his specimens did not flower till July in Calcutta.

Bulb short sub-erect with conical tip, pale yellow inside with an outer whitish zone, rhizome not further developed.

Special bracts (as in all the species) membranous, puberulous. The plant is not very aromatic.

Arrowroot is prepared from the tubers.

2. **C. sulcata,** *Haines* (*Kew Bulletin*, No. 3, 1923).

Habit of *C. angustifolia*. Leaves elliptic or elliptic-oblong, green above, pale beneath (with microscopic white dots), plicate, 8″ by 3·5″ to 15″ by 6·5″, inequilateral at the base, caudate tip ·5–·75″ long and later petioles up to 8″, green or reddish. Spike lateral in spring, central in summer, 3·5–6″ long, shortly peduncled. Flowering bracts 1–1·5″ long, free for ·5–·75″, reddish or green with brown or at the apex purple. Bracts of the coma narrowly oblong, very parallel-sided with rounded tip which is reddish-purple or violet, obscurely puberulous. Flowers exserted ·5–·75″ from the bracts. Ovary hirsute. Calyx ·3″, pink, shortly obtusely toothed. Corolla-tube slender and white for ·5″, then limb 1″ ventricose, split half-way down into two anterior oblong rounded petals and a posterior hooded mucronate petal, always tinged, sometimes deeply, with a brownish red. Lateral staminodes faintly tinged pink or red or a beautiful red-brown, exceeding corolla, oblong slightly broader upwards, entire, rounded, ·3″ broad. Lip as long, with erect sides, apex suddenly contracted to a short split umbo, sides same colour as staminodes, centre longitudinally deep yellow. Anther and filament dorsally puberulous.

This is found on high hills of the Central Provinces, and possibly in Chota Nagpur; the plant recorded under *C. rubescens* may be the same. Fl. May–Aug. Leaves appear June, fully developed July–Aug.

Bulb (rhizome ?) pale yellow within 2–4″ long, somewhat aromatic. Tubers turbinate or cylindric 1·5–3″ by 1″.

3. **C. rubescens,** *Roxb.*

Roxburgh appears to distinguish thi· from *C. angustifolia* by the shape of the bulb and tubers, the broader leaves and the colouring. The following is *Roxburgh's* account:

"Bulbs ovate-lanceolate and with the palmate tubers (rhizome) inwardly pearl-coloured. Leaves broad lanceolate, on red winged petioles above the sheaths, rib red. Scape and scales red. Fls.

longer than their bracts. . . . Root of several erect solid conical pale straw or pearl-cold., powerfully aromatic bulbs which supported the former year's foliage and are marked with scars, round their lower half issues a number of strong fleshy fibres, many of which end in ovate or sub-cylindrical, pale-white, slightly aromatic tubers. Leaves 2-farious, 6–8, 3–4 ft. long, including the sheaths and petioles, cuspidate, smooth, uniform dark-green with the nerves or ribs red, (blade) 12–24″ long by 5–6″ broad. Petioles and sheaths deep red. Scape radical, lateral, about 6″ long, invested in several dark reddish sheaths. Spike tufted, 5–6″. Coma less deeply coloured than in Zerumbet (*C. zedoaria*, *Roscoe*). Fls. small, rather longer than their bracts, bright yellow, fragrant. Tube of the corolla slender, mouth shut with three villous, yellow glands."

Singbhum, in damp forests! (if my plant is really this, see below). Fl. May; leaves appear soon after.

A living specimen was sent by me to Calcutta in 1902 and there identified as *C. rubescens*, *Roxb.*

The following were field notes: Spike with peduncle 6″–1 ft. above ground, spike 3·5–5″ long and 2″ diam. Floral bracts 1·25–1·5 long, one-half to two-thirds free, varying from green to a deep crimson, ·75–1″ broad. Bracts of coma few, magenta, oblong or elliptic-oblong, 2″, inner surface of all bracts puberulous. Fls. 1·5″ long from bright sulphur yellow with colourless corolla to a chrome yellow and a delicate pink-veined corolla. Calyx ·5″, usually with 2 distinct keeled obtuse pubescent lobes and a third split lobe. Corolla-tube ·5″, upper lobe ovate-oblong ·75″, mucronate or apiculate above the involute margin, lateral lobes shorter with flat margins. Staminodes exceeding the corolla, obovate-oblong, obtuse, lip broadly oblong-obovate 2-fid or emarginate or sometimes with a narrow middle lobe.

It will be observed that the coloration is extremely variable, and if the specimen sent to Calcutta was correctly identified, it would appear that there is little, if any, difference between this species and *C. angustifolia*, except in the shape of the leaves (which were not developed in our plant and are certainly variable in *angustifolia*), and possibly the indumentum on the ovary. This is villous in *angustifolia*, but *Roxburgh* figures it *glabrous* in *rubescens* and does not mention it in the text. I know of no authentic specimen of *Roxburgh's* plant.

4. C. leucorhiza, *Roxb.* Tikur, *H.*

Whole plant 3–4 ft. high when in leaf. Leaves broad-lanceolar, glabrous, sub-plicate (from the drawing). Spike lateral 6–8″, few-fld., and bracts of coma few, pale rose. Flowers only as long as the bracts, not at all exserted, but with a relatively long and slender corolla-tube ·6″ and a short ventricose portion. Petals ovate, dorsal slightly mucronate and hooded lateral acuminate, recurved, white slightly tinged purple. Lateral staminodes yellow. Lip ovate, white with purplish tinge, 2-fid and yellow at apex.

Jungles south of Bhagalpur, *Roxburgh.* Fl. May.

This is only known from *Roxburgh's* picture and description. Bulbs conical with several rhizomes often 1 foot long, straight and cylindrical, both very pale yellow within. Tubers ellipsoid pearly white within. *Roxburgh* says that the flowers are yellow within with the exterior border slightly tinged with pink.

Yields arrowroot.

5. C. aromatica, *Salisb.*, not *C. Zedoaria*, Roxb.? Palo, Paro, *K.*, *S.*

Leaves not mature at the time of flowering, mature lower ovate, upper ell.-oblong with the base passing gradually into the winged petiole, 16–30″ by 8–10″, with a finely twisted tail 1″ long and margin

with a white or hyaline border, surface sub-plicate with the 30–40 raised nerves, persistently puberulous beneath, young softly pubescent. Petiole 6–10″ above the sheath. Flowering stems distinct with a stem or peduncle 4–7″ and a spike 6–9″ long by 3–5″ diam. at the coma. Outer bracts sheathing soft with a minute pubescence, flowering green or slightly tinged pink, 2–2·5″ with very rounded, almost truncate tip, those of the coma pale magenta with free portion 3″ long. Flowers 2″ reaching about level with the mouth of their bracts, several to each bract and with proper membranous narrow-obovate conduplicate bracts 1·25″ long. Ovary and calyx hairy. Corolla white, upper lobe pubescent truncate emarginate with a short horn or cusp from the sinus.

Mountains of Singbhum and Mayurbhanj! Parasnath, *Kurz* (but the specimen is doubtful). My description is from specimens removed from the forest and grown in the garden so as to obtain fully developed leaves. Fl. May–June. Leaves fully developed in September.

Rhizomes 1·5″ diam., horizontal, branched, with aromatic ginger smell, dirty white or yellowish inside, lateral tubers sessile. Spike flowering nearly to the top. Calyx ·5″, scarcely 3-lobed and lobes shallowly emarginate, lateral corolla-lobes as long as staminal lip, obtuse. Lateral staminodes also as long, pale yellow oblong slightly broader upwards and with ends incurved. Lip yellow scarcely 3-lobed. Column of anther flat pubescent, anther pubescent, long-spurred.

Arrowroot is said to be derived from the plant described, but from *C. Zedoaria*, *Roxburgh* only speaks of a perfume. Although our plant appears to be the one described as *aromatica* by *Salisbury*, I am very doubtful whether it is *Roxburgh's Zedoaria* which is quoted in the *F.B.I.* as a synonym. *Roxburgh* says in one place that the tubers of *Zedoaria* are a pretty deep yellow, and in another place a pale yellow. He also refers to *Zedoaria* as being a particularly ornamental species, but our plant has too pale a coma for such a description to be applicable. He, moreover, although he described from the living specimen does not refer to the very raised nervation of the leaves, and, especially, he states in his diagnosis* that they are *sessile* on their sheaths. Lastly neither he nor the *F.B.I.* refers to the pubescence of the flowers.

6. **C. zedoaria,** *Roscoe* (non *Roxb.*). Syn. C. zerumbet, *Roxb.*; Kachura, *H., Beng.*

Whole height 3–4 ft., leaves 1–2 ft., oblong acuminate and narrowed to the very long petiole, glabrous, clouded down the middle with purple. Spikes appearing before the leaves, 6″ by 3″. Flowering bracts 1·5″, often tinged with red, bracts of the coma many, spreading, bright red. Flowers pale yellow rather shorter than the bracts. Corolla lobes pale, lateral oblong, dorsal rather longer with a subulate tip. Lateral staminodes obovate. Lip ·5″ broad, orbicular, deep-yellow, recurved, emarginate. Ovary hairy. Capsule ovoid-trigonous, dehiscing irregularly. Seeds oblong, aril lanceolate, white, cut into slender unequal fleshy segments (*Roxb.*).

Open grassy places in the Tarai and Duars, probably Purneah and Santal Parg. Manbhum, *Camp.*! Fl. April. Leafy shoot in June.

Bulb large ovoid. Rhizome well developed, cylindrical, pale yellow or straw-coloured inside. Tubers many, pearl-coloured within.

The rhizome possesses an agreeable, aromatic, camphoraceous smell. It has stimulant and carminative properties and is used in flatulence and dyspepsia, and also for clearing the throat (expectorant). The dry root powdered and mixed with the powdered wood of *Cæsalpinia Sappan* makes the red powder called *abir* which is thrown over the person during the Holi festival. *Nadkarni.*

* Though later on he says the leaves are petioled he does not mention the *long* petioles which are characteristic.

7. C. cæsia, *Roxb.* Nil-kuntha, Kala-haldi, *Beng.*

Whole height about 4 ft. Leaves 1–2 ft. by 5–6″ broadly lanceolate or oblong, glabrous, with a deep ferruginous purple cloud down the middle which penetrates to the lower surface. Petiole and sheath about as long as the blade. Spikes appearing rather before the leaves, about 6″ long or altogether about a foot high with the peduncle. Flowering bracts green with a ferruginous tinge. Coma deep bright red, tending to crimson. Flowers pale yellow, reddish at the outer border, rather shorter than their bracts.

Behar and Chota Nagpur according to *Bengal Plants*, but I can find no specimens from this area. Fl. May.

The description is mainly from *Roxburgh*. It appears to be indistinguishable from *C. Zedoaria* except by the colour of the rhizomes, and it seems to me better to regard it as a variety. *Roxburgh* says that the bulbs are ovate and these and the rhizomes a greyish blue within.

8. C. amada, *Roxb.* Ban-haldi (the wild plant); Ama-haldi, *H.*; Amada, *Beng.*

Whole plant from root to tip of leaves 2–2·5 ft. high, bearing scape from the centre of the leafy tuft. Leaves oblong-elliptic, oblong or oblanceolate, ending in a short fine somewhat twisted cusp and with a white or hyaline margin, blade 1·3–2 ft. long by 5–7″ wide. Scape about 6–12″, with a spike 3–6″ and peduncle sometimes entirely hidden in the leaf bases. Bracts white or pale green, those of the coma very few and pinkish or nearly white. Flowers 1·75″ long, exserted (in front), ·5″ more or less. Calyx very thin ·4–·5″, split above, with 3 rounded shallow lobes anteriorly, puberulous. Corolla with tubular portion ·75″ long then ventricose, anterior lobes oblong-ovate rounded, nearly as long as the lip, posterior hooded entire or very slightly emarginate in front of the large mucro or horn, embracing the lateral staminodes which are (somewhat obliquely) oblong rounded and as long as the corolla. Lip slightly exceeding the corolla, ·5″ broad, sides erect and apex very short deflexed emarginate, throat and centre deep yellow, rest of flower cream-coloured. Ovary villous.

Very common in the forests of Chota Nagpur! Fl. Aug.–Sept.

The leaves are always very slightly puberulous on the upper surface with white hairs (*Roxburgh* says glabrous, yet I don't know what else this can be but *amada*), lower surface glabrous and microscopically white-dotted, lateral nerves somewhat raised, about 20 each side. Rootstock quite small, pale yellow with white margins, fibres as usual ending in tubers. Bracts adnate half-way up, then spreading, rounded or truncate, not recurved, lower few barren and longer with a free portion of 1·5″ in length, while flowering have a free portion of about ·7″ only.

The fresh cut rootstock possesses the smell of green mango and it is said to be used as a condiment and vegetable. They are also regarded as cooling and carminative (*Nadkarni*). The Kols however tell me that they have no use for it.

Filament short broad oblong, anther reclinate, with 2 long declinate spurs and a slight knee above base of the spurs in front, connective behind with a minute ridge (these characters are, I think, generic).

9. C. longa, *L.* Haldi, *H.*; Turmerie.

Habit and stature of *C. amada*, but all parts much more aromatic. Leaves quite glabrous both sides but both sides microscopically white-dotted. Spikes short with the peduncle often only exserted 2–3″ from the leaf sheaths with 1–2 large barren bracts below, the lowest one with a filiform point over ·5″ long, floral green and those of the

coma white without (in my plants) any tinge of pink. Flowers few (sometimes only 2) to a bract, 1·75″ long, yellow, not at all exserted, their proper bracts white, sometimes fls. abortive and replaced by their proper bract. Calyx ·4″ with few fine hairs, scarcely 3-lobed, split about one-fourth way down behind and retuse in front. Lip ·6″ broad pale yellow with deep yellow centre and mid-lobe, the sides curved up at the margins, but scarcely forming distinct lobes and rather distinguished by their colour than from any division between them. Ovary rather stiffly hairy at the top only.

Cultivated more or less in all districts! Manbhum, *Camp.*! Parasnath, *Clarke*, "fls. all orange yellow." But I doubt whether this was wild as there is cultivation on a part of Parasnath. Fl. Sept.–Oct.

Rhizomes of a deep orange colour within. Earlier leaves ell.-oblong about 16″ by 6″ with a free petiole 3″, later leaves oblong 20–24″ by 5·5″ with more attenuate base and free part of petiole 6–10″ above the sheath, main lateral nerves raised above, 20–30. Bracts connate half-way up, rounded, minutely pubescent. Dorsal petal hooded and cleft and with a short slightly hairy horn or beak from the sinus, lat. pet. ovate rounded glabrous. Apex of lip retuse. Lat. staminodes large oblong with contracted inflexed tips which hide the anther and meet or overlap in front of the dorsal petal. Anther reclinate with a small yellow lamella at its apex and 2 spurs in front (much as in *C. amada*), spurs nearly as long as the anther and with a swelling above each at the base of the cell.

The rhizomes are much used in the composition of curry powders and are largely used in Hindu medicine.

10. **C. reclinata,** *Roxb.* Bundu, *K.*

A very pretty species easily distinguished from all the foregoing by the small leaves, the floral bracts, not only the flowers, a deep orange yellow, and the coma scarcely any but of the same colour.

On damp banks in the forests. Singbhum! Fl. Aug.–Sept.

Height about 1 ft. Base of stem bulbiferous and with globose tubers ·25–1″ diam. at the ends of the root-fibres. Leaves about 10″ by 4″ often bent back on their 4–7″-long petioles, elliptic, acuminate or cuspidate, base unequal. Spike central, 3–4″ long, peduncle mostly hidden by the leaf sheaths, bracts 1·5–2″ with recurved rounded limb. Flowers orange-yellow or dark pink. Calyx inflated, obscurely 3-toothed.

The tubers are cooked and eaten by the Kols. They are called *daka* or *da* as in the other species.

This is almost certainly *reclinata*, but it is to be observed that *Roxburgh's reclinata* had the flower-bracts green tinged with red and the coma bracts reddish. Our species is very distinctive in its coloration.

3. GASTROCHILUS, *Wall.*

Herbs with rootstock creeping or 0, with or without leafy stem. Flowers solitary or in a few-flowered spathe or spicate, with a short spathaceous calyx and long slender corolla-tube, petals equal connivent, narrow, ascending. Lip oblong, longer than the corolla, entire. Lateral staminodes petaloid broader. Filament very short, anther-cells parallel, connective not crested nor spurred. Ovary oblong 3-celled; ovules few or many, superposed, style filiform, stigma subglobose. Fruit an oblong capsule. Seeds ovoid with a small basal aril.

1. **G. longiflora,** *Wall.*

A beautiful herb with distichous oblong leaves 12–16″ by 4–5·5″,

pale and glistening beneath and large-lipped white flowers variegated red, which appear to be long peduncled from the very long slender corolla tubes rising from the centre of the leaves or on a short radical spike about 3″ long, corolla-tube bright red, 3–4″ long, very brittle.

Muddy streams under shade in the Singbhum forests ! Fl. June–Sept.
Root-fibres tufted. Petioles 12″ deeply channelled or almost winged above. The flowers are dimorphic and possibly 1-sexual. Petals white glistening, oblong, 1–1·25″ long. Lip very large ventricose, 2″ long, suborbicular. Lat. staminodes spathulate obtuse as long as petals. Stamen large truncate.

4. KÆMPFERIA, *L.*

Herbs with often tuberous rootstock, short or 0 stems and few leaves. Flowers spicate, on radical scapes or terminating leafy stems. Calyx short cylindrical. Corolla with long slender tube and equal, usually spreading, segments. Staminodes broad, petaloid, stamen short, arcuate, with the anther-cells separated by the broad connective which is produced above into a petaloid crest, not spurred. Lip broad, usually 2-fid. Ovary 3-celled, style long, filiform, stigma turbinate. Capsule oblong with thin pericarp. Seeds subglobose, with small lacerate aril.

A. Leaves not contemporary with the flowers :—
Leaves oval-lanceolate or oblong, erect. Fls. with white staminodes and lilac or reddish lip . . . . . 1. *rotunda.*
B. Leaves contemporaneous with the flowers :—
Leaves suborbicular, flat on the ground . . . . 2. *galanga.*
Leaves ascending, lanceolate . . . . . 3. *angustifolia.*

1. K. rotunda, *L.* Bhuin-champa, *H.*

Rootstock tuberous with large erect oblong or ovate-lanceolate leaves 12″ by 3–4″, usually variegated with darker and lighter green above and tinged purple beneath. Flowers fragrant, borne 1–3″ from the ground only, in a crowded radical spike, but only one or two opening at a time. Corolla-tube 2–3″ long with spreading linear petals nearly as long as the tube. Staminodes oblong acute white, 1·5–2″. Lip lilac or reddish, rather shorter, 2-fid, segments suborbicular. Anther-crest deeply 2-fid, lobes lanceolate.

Said to be wild on Parasnath. Wild in the Sikkim Tarai, in Sal forest, *Kew Herb.* ! Often cultivated ! Fl. March–April, after which the leaves appear and die down in November or December.

2. K. galanga, *L.*

Tuberous-rooted with suborbicular leaves overlapping one another flat on the ground, 3–6″ long, deep green and forming a pretty background to the delicate flowers, 6–12 of which are fascicled on a very short central spike and open in succession. Corolla and staminodes a pearly white, lip with a purple or lilac spot each side. Corolla-tube 1″. Anther-crest quadrate with 2 small rounded lobes.

Wild in the Sikkim Tarai, *Kew Herb.* ! Said to be in the plains throughout British India. I have only seen it in cultivation. Fl. r.s.
The roots and leaves have a delicate fragrance, but the flowers are inodorous (scented, *Baker* in *F.B.I.*).

3. K. angustifolia, *Roscoe.*

Tuberous-rooted with ascending lanceolate leaves 6–8″ long by 1″ broad. Flowers white with lilac lip deeply cut into 2 obovate lobes. Corolla-tube 2″, petals 1″. Anther crest quadrate with suborbicular lobes.

Sikkim Tarai, *C. B. Clarke*! Northern Bengal (*Bengal Pl.*), possibly Purneah. Fl. May–July.

5. HEDYCHIUM, *Koenig.*

Rootstock a rhizome or tuberous with elongate leafy stems and distichous oblong or lanceolate leaves. Flowers mostly in dense imbricately bracteate terminal capitate spikes, rarely spikes lax, bracts coriaceous, 1–more-fld. Calyx tubular, 3-toothed. Corolla-tube long, slender with linear equal spreading petals. Lateral staminodes various. Filament narrow, anther-cells contiguous, connective not produced nor appendaged. Lip large 2-fid. Ovary 3-celled; ovules many superposed; style long, filiform; stigma subglobose. Capsule globose, 3-valved.

I. Spike strobiliform with very broad appressed imbricate bracts. Stamen not much exceeding the lip . . . . 1. *coronarium*
II. Bracts narrow oblong or convolute, not overlapping laterally. Stamen far exceeding the lip :— . . .
A. Spike dense ovoid or broadly oblong. Flowers pure white. Lip cuneate . . . . . 2. *thyrsiforme.*
B. Spike elongate cylindric, not very dense :—
1. Lip more or less cuneate :—
L. sericeous beneath. Flowers white . . . 3. *stenopetalum.*
L. white-pulverulent beneath. Fls. lemon-yellow . *Gardnerianum* (p. 1139).
2. Lip suborbicular above the claw. Fls. red or carneous . . . . . 4. *coccineum.*

1. H. coronarium, *Koenig.*

A stout handsome leafy rhizomatous herb 2–5 ft. high, usually suberect with the spike erect. Leaves thinly appressed-silky, pubescent or quite glabrous beneath, sub-patent, lanceolate, 1–2 ft. long, variable in breadth, sessile. Flowers fragrant, usually pure white (in our area), a few opening at a time exserted from the axils of the very closely imbricate orbicular or oblong-obovate very broad bracts of the large conical 4–7″-long head, the lower bracts sterile, the upper each containing a cluster of 3–4 flowers, the special bract of each flower enclosing all the special bracts of the next younger flowers.

Along watercourses. Ranchi and Palamau, over 2000 ft.! Jonha (Manbhum), *Wood*! Santal Parg.! Mayurbhanj, elev. over 3000 ft.! It is common in the wet savannahs of the Jalpaiguri district and will probably occur in Purneah. Fl., Fr. r.s. up to Oct.

The yellow-fld. form or variety is seen in cultivation. The Santal Parg. form has leaves only 2″ wide, others up to 3″, crowded with microscopic white dots beneath, often purple beneath when young, tapering both ends, apex acuminate; uppermost often partially clasping the base of the spike with the blade reduced to an involute appendage. Lowest bracts 1·5″ broad, margin usually densely pubescent. Calyx 1·2–1·5″ long, sparsely hairy, translucent, 10-nerved. Corolla-tube 3″ or more. Petals linear or linear-oblong, 1–1·25″. Lip orbicular-obcordate or obcuneate, 2-fid, spreading together with the two lateral oblong or subrhomboid staminodes from the mouth of the tube. Staminodes ·75″ by ·5″ and lip slightly over 1″ diam. in the 6-ft.-high Duars form, staminodes 1·5″ by ·9″ and lip 1·75″

by 1·5″ wide in the much dwarfer Chota Nagpur and Orissa plant, lip tinged yellow down the centre (var. *chrysoleucum*, *F.B.I.* ?) in the Chota Nagpur plant. Filament white, anther yellow in our plant, but in the Jalpaiguri plant the filament was practically obsolete.

Our species requires re-study in the light of *Turrill's* article (*Kew Bulletin*, 1914) on *Hedychium coronarium*. He segregates it into 7 species and one variety. *Schumann* also segregates this variety (*maximum* of *coronarium*), and in addition keeps separate *flavum*, Roxb., *flavescens*, Carey, *chrysoleucum*, Hook., and *Elwesii*, Bak.

H. coronarium proper certainly occurs in our area but possibly also some of the others.

2. H. thyrsiforme, *Ham.*

Stems inclined, 3–4 ft. high with the spike erect. Leaves oblong or broadly lanceolate, 12–20″ long by 3·5–4·7″ broad, shortly finely caudate, hairy or pilose beneath, thinly margined, base much or slightly narrowed to a ·5–·75″ long petiole, ligule large, ·7″ long, very hairy, with very obliquely truncate mouth. Spike dense but the bracts not laterally imbricating, convolute around two (perhaps more) inner bracts and one (or sometimes more ?) flowers. Flower white, corolla-tube not much exceeding the 1–1·5″ long bract, petals 1″ linear, staminodes as long more broadly linear or linear-lanceolate, lip narrow 2-partite, segments lanceolate. Filament 1·75–2·5″, anther (when dry) linear, ·4″ long. Ovary very hairy.

Ramnagar Hills ! Fl. r.s.

The flowers in my specimen were much withered and the description of them is mainly taken from the *F.B.I.* Leaves sometimes elliptic, paler below. Sheaths sometimes purpurascent, villous, terminating in long obtuse ligule. Calyx 3-toothed, sheathing about three-fourths corolla-tube.

3. H. stenopetalum, *Lodd.*

Height 6–7 ft. Leaves oblong or elliptic-oblong 18″ by 4·5″ to 20″ by 5·25″ (sometimes 24″ by 6″, *F.B.I.*), closely subsericeous beneath but more or less glabrescent in fruit, ligule large, 1–1·2″ long, obtuse, villous on the back as is the margin of the sheath. Petiole 0. Spike 8–12″ long or more, lax, with very stout rhachis and convolute oblong spreading bracts 2–5-fld. Flowers pure white, total length (with stamen) 3·5–4″. Ovary villous. Calyx ·7–·9″, villous above. Corolla-tube 1·3–1·5″ with narrowly linear twisted petals over 1″ long. Lateral staminodes linear-lanceolate or oblanceolate, ·8″. Lip 1″, deeply 2-fid with linear-oblong lobes ·3″ long, entire portion narrowly obcuneate.

In wet savannahs, Tarai and Duars ! Probably also Purneah. Fl. Aug.–Sept.

Schumann states that the lobes of the lip are acuminate; they are only acute in my plant and are even obtuse in some of the Kew specimens.

Hedychium Gardnerianum, *Rosc.*, is sometimes cultivated as an ornamental plant in gardens and may easily be recognized by the rather broad leaves white pulverulent beneath, and the lemon-yellow flowers in long spikes 12–18″ long. Staminodes oblanceolate over 1″ long. Lip obovate-cuneate. Filament bright red.

4. H. coccineum, *Ham.*

Leaves narrow, about 1·5″ broad, with fine scattered hairs on margin and midrib beneath. Ligule about 1″. Spike up to 1 ft., lax, with a triangular villous rhachis and bracts more or less ternate in 6 vertical

rows, lanceolate villous. Flowers scarlet or brick-red or flesh-coloured, 2·5–3″ long. Petals twisted narrowly linear. Staminodes lanceolate. Lip suborbicular split into 2 ovate-oblong or irregularly sub-ovate obtuse lobes, clawed.

Baragai Hill (Ranchi Ghats), " elev. 4000 ft.,"* *Wood.* It is a plant of the Himalaya.

6. AMOMUM, *L.*

Herbaceous leafy stem often very tall, rootstock rhizomatous. Leaves usually narrow, distichous. Flowers in dense capitate spikes produced direct from the rootstock, with imbricate bracts. Calyx cylindric, 3-dentate. Corolla-tube with oblong or linear-oblong segments, upper often broader and more convex. Lateral staminodes reduced to minute teeth or obsolete. Lip broad or linguiform. Filament short, arcuate; anther-cells divaricate, sometimes hairy and often with a petaloid crest. Ovary 3-celled. Style filiform, stigma small and globose or larger and gibbous dorsally. Ovules many, superposed. Fruit indehiscent or irregularly dehiscent, sometimes beaked, winged or echinate. Seeds globose or truncate.

A. Anther crested. Lip broad:—
Anther-crest ·25–·3″ wide, entire. Capsule winged . . 1. *dealbatum.*
Anther-crest large, 3-fid. Capsule 3-gonous . . . 2. *aromaticum.*
B. Anther not crested. Lip narrow . . . . . 3. *linguiforme.*

1. A. dealbatum, *Roxb.* Paro, *K.*

A very large herb with tuberous rootstock and leafy stems 5–7 ft. high with sheathing distichous oblong-lanceolate leaves 2–3·5 ft. long and 4–6″ broad, softly pubescent or glabrous beneath. Flowers 2″ long (from tip of ovary to tip of lip), in dense spikes 2–3″ long and broad on a short stout peduncle sometimes 3″ or in fruit 4″, densely covered with bracts when young. Lip 1·5″ long by ·75″ wide with crisped margins or 1·1″ wide (in the Puri specimen), a band of yellow or red down its centre and sometimes also radiating red veins. Crest subquadrate ·25–·3″ wide. Fruit oblong 1·6″ long with 9 crenulate wings.

Purneah! Santal Parg.! Singbhum, in watery shady places! Parasnath! Mals of Puri, frequent! Fl. April–July. Fr. Aug.–Sept. Leafy stem apparently persists several years.

The leaves of the Singbhum plant are glabrous. The peduncle is naked in fruit. Whole length of flowers (including hypanthium) 2·5″. Calyx ·75–1″ minutely pubescent.

2. A. aromaticum, *Roxb.* Morung-elaichi, *Beng.*; Jalpaiguri Cardamom.

Stems in tufts from the rhizome, 2–3 ft. high. Spike globose 1·25–1·5″ with the peduncle subterranean (but somewhat elongating in fruit) with imbricating sheathing bracts. Floral bracts oblong, ribbed, mucronate. Flowers pale yellow. Ovary sericeous. Calyx ·7–·8″ long, villous, 3-toothed. Corolla-tube 1″ villous, petals nearly as long, sometimes white tinged with brown, sublanceolate, obtuse

* I think the correct elev. is 3607 ft.

dorsal somewhat cucullate. Lip twice as long as the petals, sub-orbicular with cuneate base. Anther-crest about ·25″ diam. with 3 acute lobes. Fruit narrowly obovoid (ovate, size of a large nutmeg, *Roxb.*), 1·3″, somewhat rugose, 3-valved. Seeds several in each cell.

Cultivated in the wetter districts near the foot of the Himalayas. Fl. May. Fr. Sept.

The seeds are used as spice and medicinally. They resemble cardamoms in flavour.

The true *Cardamom* is derived from *Eletturia cardamomum*, which is cultivated in the Himalayas to the north of our area under the shade of trees and where the rainfall is over 100″

3. A. linguiforme, *Benth.*

Rootstock creeping with leafy stems 4–8 ft. high ending in a fine point (undeveloped leaf). Leaves oblong-lanceolate 3–4″ apart, 12–18″ long by 2–4″ broad, quite glabrous, ending in a filiform tip. Spikes (according to *Roxburgh*) linear, rather lax with the apex only rising above the soil (mine are in fruit, 6″ high and dense), outer bracts ovate whitish glabrous, inner lanceolate, pink. Corolla-tube cylindric, 2″, segments oblong, bright red. Lip bright yellow, linguiform, deflexed, above 2″ long, 2-fid, margins below the middle incurved.

My plant, from which the locality "Northern Bengal" in *Beng. Pl.* is given (named *linguiforme* in *Cal. Herb.*, but only in fruit), is very common in the Sal forests of the Tarai and Duars and almost certainly occurs in Purneah. But the description of the flower is from *Roxburgh* and the *F.B.I.* Fl. r.s. Fr. ripens Sept.

The *F.B.I.* describes the leaves as attaining 5″ in width; they are narrower upwards on the stem. Fruit (not described by *Roxburgh*) is oblong or sub-globose, ·5–·75″, green or yellowish green, glabrous. Seeds triquetrous in a white aril. Smell fœtid of garlic.

7. ZINGIBER, *Adans.*

Rhizome horizontal with leafy stems and mostly oblong-lanceolate leaves. Flowers in dense bracteate spikes which are usually radical (in one of our species terminal), bracts mostly 1-fld. Calyx shortly 3-lobed. Corolla with lanceolate segments, upper concave. Lateral staminodes 0 or small and adnate to the obovate-cuneate often 3-lobed lip. Stamen with short filament and contiguous anther-cells, the connective produced into a narrow crest or beak as long as the cells. Ovary 3-celled, style filiform, stigma small, subglobose. Ovules many, superposed. Fruit an oblong capsule, sometimes tardily dehiscing, with large globose arillate seeds.

I. Spikes radical or from the base of the leafy stem :—
  A. Floral bracts narrow, not closely imbricate. Peduncle hypogeal. Lateral lobes of lip 0 or very small :—
    Spike only 1–2″ long. Inner bracts linear-lanceolate. Lip linear-oblong or, when spread out, ovate oblong, spotted or streaked with red. Stamens red . 1. *rubens.*
    Spike 3–4″. Inner bracts oblong or lanceolate. Lip oblong unspotted, with waved basal flanges and shallowly-lobed or waved terminal lobe (all recurved). Stamen yellow . . . . . 2. *roseum.*
  B. Floral bracts broad and closely imbricate. Peduncle of spike usually elongate (exc. 5, var.). Lateral lobes of lip well developed :—
    1. L. under 1″ wide. Fls. with dark purple lip and stamen . . . . . 3. *officinale.*

2. L. over 1″ broad. Flowers yellow :—
   a. Spikes long-peduncled, very stout :—
      Fl.-bracts usually green. Lobes of lip orbicular. Heads usuallywith broad rounded top — 4. *zerumbet.*
      Fl.-bracts usually deep red, hairy. Lobes of lip oblong. Heads usually conical . . — 5. *casumunar.*
   b. Spikes scarcely peduncled, oblong . . . — var. *pulamaunsis.*
II. Spike terminating the leafy stem . . . . — 6. *capitatum.*

1. Z. rubens, *Roxb.*

Leafy stem 3–4 ft. high with narrowly elliptic-oblong erecto-patent leaves of which the larger are about 16″ by 4″, paler and thinly appressed hairy beneath, and with minute glistening glands in the fresh plant. Flowers 1·7″ (to tip of dorsal petal), red, in small narrow heads 1·5–2″ long only, sessile from the base of the stem or with a peduncle (under the surface of the ground) 1″ long. Bracts not closely imbricate (as in the *Casumunar* group), but free, linear-oblong, red, flowering 1·2″. Calyx spathaceous membranous. Corolla-tube 1·2″. Lip linear-oblong, ·9″, expanded at the base then recurved and with recurved undulate margins, white, beautifully veined or spotted with red, puberulous. Stamen shorter, red, arching over the lip, appendage or beak incurved.

Ranchi, over 2000 ft. ! Fl. Aug.–Sept. Fr. Sept.

Stem above with minute sparse hairs. Leaves sometimes 4·5″ broad : there is often a very small one (2″ only) at the base of the stem, tip with a slender but not filiform acumen. Ligule membranous, ·4–·5″. Spike with about 2 basal barren oblong boat-shaped (longitudinally concave) obtuse red bracts 1″ long. Opposed to each flowering bract is a linear convolute notched hairy bract. Cor.-lobes, linear acuminate red, ·8″. Staminodes or basal lip auricles 0 or minute. Ovary pubescent. Stigma simple with a ring of terminal short hairs. Capsule reddish, slightly compressed or angled, straight or slightly curved, lanceolar in outline, hairy. Seeds ·2″ long, 3 in each cell, oblong, red-streaked, completely enclosed in a white aril which is lobed at the apex.

2. Z. roseum, *Rosc.* Syn. Amomum roseum, *Roxb.* (*Cor. Pl.*).

Leafy stem about 4–4·5 ft. high with ascending distichous leaves 16″ by 3·5″ indistinguishable from those of *Z. rubens*. Heads oblong, 3″, with bright red bracts, lowest one or two empty, ·75–1″ long, next narrow-oblong 1·5″ by ·3″, obtuse or retuse inner lanceolate, all, but especially the inner hairy. Flower about 2″ long, corolla bright red. Lip oblong recurved and with a recurved crisped margin, broad short lateral segments or flanges and a sub-3-lobed terminal segment, pale with or without light red markings. Basal auricles small, obtuse. Stamen as long as the lip or a little shorter, bright yellow.

Sal forests in Singbhum, frequent in moist situations ! Fl. Aug.–Sept.

These two species may be the same, although the drawings with weak and strong inflorescence respectively look very different. Mine were described from actual living specimens, but with an interval of 14 years, and if the spotting and colouring is less important than supposed, *roseum* might well be a form of *rubens* with a more robust inflorescence. Neither *Roscoe* nor *Roxburgh* gives the colour of the stamen in *roseum*. My flowers are exactly those of *Roxburgh's Amomum roseum*, but the lower bracts are shown in his figure (*Cor. Pl.*, t. 126) *as orate* and upper as lanceolate. *Clarke* has also collected this species from Chota Nagpur and in his specimen all the bracts are oblong. *Roxburgh* describes the leaves of both species as smooth (*i. e.* glabrous), and the lip of both as entire. Of *roseum* he says that the colour is a mixture of red and yellow.

3. **Z. officinale,** *Rosc.* Adrak, *H.*; Ginger.

Rhizome stout tuberous with erect leafy stems 2–4 ft. high. Leaves narrow, distichous, subsessile on the sheaths, linear-lanceolate, ·4–·8″ wide, glabrous. Flowers greenish with a small dark purple or purplish-black lip, in radical spikes 1·5–3″ long and 1″ diam. on peduncles 6–12″ long. Stamen dark purple, as long as the lip, rather shorter than the corolla.

Cultivated occasionally ! Fl. r.s.–Oct. But it very rarely flowers.

4. **Z. zerumbet,** *Smith.* Pharo, *Uraon*; Makabari-bach, *H.*

Leafy stems 3–4 ft., oval in section, with 8–12 leaves each side, middle ones larger, 12–15″ by 3–3·5″, elliptic-lanceolate (oblong-lanc., *Baker*), ending in a short finely acuminate tip under ·5″ long, base rounded, beneath rather paler and very thinly silky when young, more or less permanently so on the sulcate midrib, sec. n. very oblique and numerous. Petiole ·2″ and upper part of sheath somewhat yellow-silky; ligule ·5–1″, rounded. Flowers very pale nearly uniform yellow, 1·8″ long, tubular-ventricose, exserted ·5–·8″ from the ellipsoid-oblong green head, which is borne on a peduncle 9–10″ long clothed with sheathing tubular bracts. Lip with lateral lobes suborbicular ·6–·7″ diam. (when spread out), thin, wrinkled, nearly as long as the corolla, many-nerved, mid-lobe deeply emarginate or lobed, lateral lobes broad and rounded, three-fourths as long, wrinkled.

Palamau jungles ! Cultivated in Ranchi ! Fl. Aug.–Sept. Probably also wild in other forest districts.

Rhizome resembling that of the *ginger*, whitish outside, pale-yellow inside. Leaves described by *Baker* as glabrous, probably from old specimens. Spikes or heads 2·5–3·5″ long by 1·5–1·7″ diam. when young, *Baker* says 3–4″, but the spikes gradually elongate with age as in other species. Sheathing tubular imbricate bracts with cuspidate tip, that at base of head large ovate or paraboloid, 1·5″, with cuspidate tip, flowering truncately sub-orbicular with apiculate tip and hyaline hirsute margin, the hairs deciduous. Wrapping the flower is an inner hyaline bract 1″ long with rounded tip. Calyx ·75″, sheathing, very hyaline, tip rounded entire with a few hyaline hairs, base and ovary sparsely hairy. Corolla-tubes slender tubular, ·7″. Upper corolla segment broader than the two others, 7-nerved, others lanceolate acute 3-nerved. Stamen ·6–·7″. Fil. very short and broad, minutely puberulous. Connective ·17″ broad, beak with incurved edges, shorter than the cells, which reach three-fourths of the way up. Stigma surrounded by a ring of hairs.

The rhizome appears to be used in the same way as ginger.

5. **Z. casumunar,** *Roxb.*

A large aromatic herb, taller but more slender than the preceding with the leafy stems 4–5 ft. high, base with sheaths or small leaves, the margins of the sheaths very pubescent. Leaves very numerous on each side, lanceolate to linear-oblong, lower spreading nearly at right angles from the stem, 9″ by 1·7″ to 12″ by 2″ in our area (in the Tarai and Duars they attain 20″ by 2·5–3″), pubescent beneath, or midrib hairy and very few scattered hairs on the blade; petiole and edges of sheath hairy, ligule of 2 small lateral auricles and a line of hairs between. Head cylindrical, becoming conical with age, 3–8″ long with closely imbricating broad bracts pubescent on the edges and usually stout peduncles (see var.) 3–8″ long with tubular sheaths. Flowers 1·5″ long (above the ovary), corolla segments ·75″, the upper-

most broader than the others, white or almost colourless. Lip shorter, wrinkled, yellowish 2-fid, ·75″ broad and lateral lobes large oblong rounded. Stamen yellow, beak curved, as long as the anthers. Seeds black polished with white aril.

In damp shady forests. Common in Chota Nagpur! No doubt also in forest lands of Purneah, Santal Parg., and of the Southern Area. Fl. Aug.–Sept. Fr. Oct.–Nov.

Rhizome short, deep yellow within, with fleshy roots. Stem ellipsoid in section. Peduncle pubescent, sheaths not usually overlapping one another. Heads 2″ or more in diam. in robust plants, elongating with age and becoming acute. Bracts of head usually red or becoming red with age, margined. Capsule scarlet, fleshy, with about 6–10 subglobose-oblong, sometimes somewhat angled seeds in each cell.

All parts of the plant are very aromatic, but it does not appear to be used.

This is rather a variable species, especially in size of peduncle, but usually easily recognizable by the indumentum, long-peduncled heads, orbicular margined bracts and cream-coloured or pale-yellow flowers with oblong not orbicular side-lobes to lip. The following must, I think, be treated as a variety, though it lacks the elongated peduncle of the section. The flowers of both are copiously covered when dry with minute purple dots (glands ?), which are not noticeable when they are fresh.

Var. **palamaunsis.**

Very aromatic with linear leaves, larger about 10″ by 1·2″, finely acuminate, minutely white-dotted above when fresh (as in type), sheaths, ligule and indumentum as in *Z. casumunar*. Spike very small, 2″ long by ·8″ diam. only, just raised above the ground: peduncle 1–2″ long from rootstock or side of stem but below ground, its upper bracts green and clasping the base of the spike. Flowering bracts red broadly obovate rounded with a membranous pubescent margin and minutely apiculate, back very thinly shortly hairy. Whole flower (including ovary and hypanthium) 2·3″ long, white or cream-coloured; tube of hypanthium 1·5″ before it becomes ventricose, enclosed by an inner convolute reddish bract 1″ long, which is ell.-oblong, obtuse and pubescent at the tip. Calyx ·6–·7″, spathaceous, membranous, apex rounded ciliate, slightly 2-lobed, ovary silky. Dorsal petal oblong-lanceolate, slightly concave and curved, but not galeate, ·8″ by ·35″, 9-nerved, subacute, lateral as long linear-lanceolate, ·15″ broad. Lip somewhat crisped and jagged, ·8–1″ long, midlobe ·8″ broad, lateral lobes ·6″, obliquely oblong. Stamen cream-coloured, curved about three-fourths over the lip, ·12″ broad near base, beak 2-toothed.

Palamau. Fl. Aug.–Sept.

6. **Z. capitatum,** *Roxb.*

A very aromatic plant with leafy stems 3–4 ft. high with distichous erecto-patent stiff linear leaves 12–18″ by 1–1·5″ tapering to a point, more or less pubescent beneath, quite sessile on the sheath, ligule very short. Head 3–5″ long by 1–2″ diam. terminating the stem, with closely imbricate oblong, or lower ovate-oblong, green or subsequently scarlet bracts 1·5″ or upper 1″ long, with narrow brown margins. Flowers pale yellow. Petals 1″. Lateral staminodes large oblong obtuse adnate to lip, red. Lip orbicular emarginate, ·7–·8″ broad.

Common in the damper forests and often in grass lands throughout Chota Nagpur ! Probably in all districts. Fl. r.s. Fr. Sept.–Oct.

Well marked by the terminal spikes, and, like other species, often conspicuous by the bright red valves of the widely open fleshy capsules well into the cold season.

8. COSTUS, *L.*

Rootstock tuberous with long leafy stem. Flowers large in dense-flowered, usually terminal, heads or spikes. Calyx with short tube, funnel-shaped with ovate teeth. Corolla-tube not longer than the calyx, segments large, subequal. Lateral staminodes 0 or minute. Lip large, obovate with margins incurved. Filament forming with the connective an oblong petaloid process in the middle of which are placed the contiguous linear anther-cells. Ovary 3-celled; style filiform, stigma with a semilunar ciliated depression. Ovules many, superposed. Capsule globose or ovoid, finally dehiscing on one side between the ribs. Seeds subglobose or obovoid with short aril.

1. C. speciosus, *Smith.*

A handsome plant 2–6 ft. high, the stem usually spiral so that the distichous leaf arrangement is no longer apparent. Leaves elliptic-oblong, 6–12″, thinly silky beneath. Flowers very large, pure white, in terminal dense heads 2–4″ long with scarlet ovate bracts 1–1·5″ long.

Generally distributed, in moist localities in long grass and in the forest. Chota Nagpur, common ! Puri and Angul, common ! Fl. July–Sept.

The stem is more solid than in most of the previous genera. Calyx 1″. Petals 1–1·5″. Lip suborbicular, 2–3″, with the incurved margins usually meeting.

The rootstock is eaten.

9. ALPINIA, *L.*

Usually very tall, often gregarious, herbs with tuberous or creeping rootstock and leafy stems which terminate (with few exceptions not in our area) in the inflorescence. Leaves distichous, usually narrow. Flowers rather small to very large, in racemes or panicles, often enveloped in bud by the convolute bracts. Calyx laxly tubular, shortly 3-toothed. Petals narrow, upper usually broader and more concave. Lateral staminodes 0 or very small; lip large, sometimes with 2 subulate processes at the base of the claw. Filament flattened, anther-cells divergent above, connective furnished rarely with an orbicular crest. Ovary 3-celled, style filiform, stigma subglobose. Ovules few or many. Fruit globose, usually dry and indehiscent, irregularly breaking up. Seeds globose or angled.

I. Inflorescence panicled :—
  A. Flowers rather small, lip under 1″ long. Bracts small :—
    Bracts small ovate amplexicaul, persistent . . . 1. *allughas.*
    Bracts oblong, ·4–·5″, free, subpersistent . . . 2. *galanga.*
  B. Flowers large or mod.-sized, lip 1–1·5″. Primary bracts minute or 0. Fl.-bracts very large, wrapping round and covering the bud, finally circumsciss at base :—
    Bracts open. Inflor. dense erect, pyramidal . . . 3. *calcarata.*
    Bracts closed. Inflor. lax, cernuous . . . . 4. *speciosa.*
II. Inflorescence simply racemose. Bracts as in I, B :—
    Bracts wrapping the bud white and wax-like . . . 5. *malaccensis.*
    Bracts wrapping the bud soft and greenish . . . 6. *bracteata.*

1. **A. allughas,** *Rosc.* Taro, *Vern.*; Elephant Grass.

A gregarious herb 4–6 ft. high with somewhat compressed stems and distichous oblong glabrous leaves, larger 20″ by 3·5″ (12–18″ by 3–6″, *F.B.I.*), with a short sharp acumination or cusp (a fine twisted point, *Roxb.*), base contracted into a short petiole ·3–·4″ long; sheath glabrous, minutely striate and lacunose; ligule ·15″, obtuse, shortly pubescent. Flowers rather small, pink, in slender but very compound pubescent or somewhat tomentose panicles 8–12″ long with small ovate amplexicaul persistent bracts. Calyx pubescent, ·3–·5″. Petals linear-oblong, greenish-white, ·3–·5″. Lip cuneate, pink, 2-fid or emarginate with 2 linear-subulate glands at the base, strongly 2-veined with a deeper pink, clawed. Anther pinkish, cleft. Capsule usually globose, ·5″ diam., black, but sometimes (in our Purneah plant, which is apparently this) ellipsoid, ·6–·7″ long, irregularly transversely breaking up, at first dull red, finally black, beaked by the calyx-tube. Seeds 4–6 in each cell irregularly globose, enclosed in a white pithy flesh.

This appears to be the commonest of the *Alpinias* in wet places in the open, often forming a dense jungle in the Tarai and Duars, and common in Purneah! Fl. May–June. Fr. Nov.–Dec.

2. **A. galanga,** *Sw.* Taro, the vernacular name for all the genus.

A very large herb growing mixed with other *Alpinias*, 6–7 ft. high, with oblong-lanceolate glabrous leaves 1–2 ft. by 4–6″, glossy both sides lowest reduced to sheaths, ligule short rounded ciliate. Flowers small in close panicles 6″–1 ft. long with a densely pubescent rhachis and numerous short branches. Bracts small, ovate, concave. Calyx greenish-white, ·25″. Petals ·3–·5″, linear-oblong, greenish-white. Lip clawed, ·5″, obovate, emarginate, white veined with lilac, and with reddish subulate basal glands. Stamen shorter. Fruit orange-red with 3–5 seeds.

Wet savannahs. Fl. April–May. Frequent in the Tarai and Duars and probably in Purneah. Chota Nagpur, *Wood* (but I have seen no specimen). Said to be often cultivated.

3. **A. calcarata,** *Rosc.*

Slender, 2–4 ft. high, with lanceolate leaves 6–12″ by 1–2″, glabrous. Flowers handsome, usually 3–4 crowded on the lower branches of a dense pyramidal panicle only 3–4″ long with pubescent rhachis and white boat-shaped or oblong bracts ·5″ long. Corolla white. Lip beautifully variegated with red and yellow, emarginate, 1–1·5″, base spurred.

Cultivated only in our area. Fl. April–June.

4. **A. speciosa,** *Schumann.* Syn. A. nutans, *Roscoe.*

Height 8–10 ft. with oblong-lanceolate leaves 1–2 ft. by 3–6″, finely pubescent beneath. Flowers handsome in slightly compound cernuous panicles 6–12″ long with very hairy rhachis, bracts 1″ long or more. Lip ovate 1·5″ long and broad, beautifully variegated with red and yellow, margins much incurved, not variegated, base spurred. Capsule red globose.

Wild in the Duars and eastwards. Only cultivated in our area. Fl. r.s.

5. **A. malaccensis,** *Rosc.*

Stems stout, 6 ft. or more. Leaves often 3–4·5 ft. long by 6–8·5″ broad, narrowly oblong, narrowed and one-sided at the base, with a villous cusp at apex, somewhat hairy or pubescent, especially on the midrib beneath, and with a densely villous marginal vein. Petiole 2″. Ligule rounded, ciliate. Inflorescence racemose supported when young by about 3 large caducous lanceolate thinly hairy bracts 6–8″ long. Raceme 9–12″ many-flowered with fulvous-hairy rhachis. Pedicels ·25″, hairy and pubescent. Buds a beautiful waxy white enclosed in a large white petaloid convolute bract 1·5″ long. Flowers 2–2·25″ long and 1·5″ broad with base of hypanthium (round the ovary) densely pubescent and with stiff hairs. Petals over 1″, white. Lip 2″ (*Roxburgh* says when expanded 3″ broad and 2·75″ long; no doubt a more robust specimen), sides inrolled and margins crisped, apex somewhat produced and deeply emarginate, colour yellow with the centre variegated a deep red and yellow, base with 2 ascending horn-like glands. Capsule globose, yellow, ·75–1″ diam., hairy. *Roxb.* says 3-valved (but I have not seen it dehiscent). Seeds many.

This occurs usually in damp forests, not in savannahs. Frequent in Tarai and Duars! Purneah, probably. Mals of Puri! Fl. April–May.

6. **A. bracteata,** *Roxb.*

Very stout leafy herb with inclined stems and erect raceme. It much resembles the last, but the brittle bracts enclosing the buds are greenish to red.

It occurs in the Duars but has not yet been noticed in our area.

FAM. 157. CANNACEÆ.

Perennial rhizomatous herbs with large penninerved leaves and usually brilliantly coloured asymmetric flowers in spikes or panicled cymes. Calyx of 3 free sepals. Corolla with 3 perianth segments connate at base. Andrœcium consisting of a variable number of members, 1–5, partly adnate to the corolla tube. One of these is fertile bearing a single marginal anther-cell, the rest of the stamen being petaloid. Opposed to the fertile stamen is a recurved petaloid staminode (labellum) which is homologous with the cucullate staminode of the *Marantaceæ*; the other 2–3 petaloid staminodes (lateral staminodes) are usually erect. Style adnate at the base to the staminal tube, then broad and flattened, somewhat curved; stigma small, terminal and oblique. Ovary 3-celled with 2 rows of anatropous ovules in each cell. Fruit capsular, 3-celled, papillose, tuberculed or echinate. Seeds several, globose. Embryo straight, surrounded by perisperm.

1. CANNA, *L.* (The only genus).

1. **C. indica,** *L.* Indian Shot.

Var. **orientalis,** *Rosc.*, common in damp waste places, especially near villages. Fl., Fr. r.s. The rest of the genus is American, and various varieties are largely grown in Indian gardens.

Height 3–4 ft. L. 12–20″. Fls. deep red with greenish petals 1″ long and much longer than the tube. Outer staminodes 3 oblanceolate emarginate, lip

reflexed emarginate at the truncate apex. Capsule globose ·75″ with round black hard seeds the size of a pea.

FAM. 158. MARANTACEÆ.

Perennial herbs or shrubs of various habit with distichous closely penniveined unequal-sided leaves with a long or short petiole above the sheath with a characteristic knee or swelling. Flowers mod.-sized or rather small paired in the bract axils and bracts distichously (exc. *Calathea*) arranged in spikes, or panicled. Flowers asymmetric. Calyx and corolla usually distinct. Sepals 3 free. Corolla-tube with 3 petals. Andrœcium tubular below. Of the 3 stamens of the outer whorl only 1 or 2 are developed as petaloid staminodes (lateral staminodes) or sometimes all 3 fail. Of the inner staminal whorl, one stamen only is fertile, and this has only one perfect anther-cell, the other half of the stamen being petaloid; the other two are staminodes of peculiar form, one contracted above and furnished on one side with a hood-like appendage (cucullate staminode), and a broader often hardened staminode (callous staminode or labellum). Ovary inferior, 3-celled, or through suppression, 1-celled. Style stout, curved, often lobed above, at first included in the cucullate staminode. Ovule 1 in each cell. Fruit dry or fleshy, dehiscent or indehiscent. Seed with perisperm and curved embryo and usually arillate.

I. Ovary 3-celled :—
  A. Suffruticose, 2-chotomously branched. Fls. terminal . 1 *Clinogyne.*
  B. Herbaceous. Stem short, unbranched or rhizomatous :—
    Stem with 1 leaf and a lateral head of flowers . . 2. *Phrynium.*
    Stem or rhizome several leaved. Fls. densely spicate . *Calathea,*
II. Ovary 1-celled :— (p. 1149).
  Inflor. terminal, fl. pedicelled on the slender branches . . 3. *Maranta.*

1. CLINOGYNE, *Salisb.*

Shrubby or sub-herbaceous with tuberous or woody rootstock and copiously 2-chotomously branched leafy stems. Flowers mod.-sized paired in terminal panicles or panicled spikes with long narrow bracts. Sepals short free. Petals narrow, connivent. Staminal-tube cylindric with obovate petaloid unequal segments and a 1-celled anther adnate to the margin of staminal segment. Ovary 3-celled, style adnate below to the staminal tube, free and hooked above with capitate hollow stigma. Ovules 1 in each cell. Fruit indehiscent with 1–3 subglobose seeds with a lacerate aril and curved embryo.

1. **C. dichotoma,** *Salisb.* Khorsong, *Or.*; Kanchan, *Khond.*; Muktapati, *Beng.* (*f. Roxb.*).

A bamboo-like undershrub with slender cylindrical stems attaining 10–12 ft. high and 1″ diam. Leaves ovate to elliptic-oblong or ovate-oblong, 4–6″, cuspidate, rounded at base. Flowers white in short 2- rarely 3-fld. lateral bracteate, shortly panicled racemes with dry lanceolate bracts 1·5–2″ long. Sepals ·3″ long. Petals 1·2″. Staminal tube elongate. Labellum with a hard saccate base. Ovary

tomentose. Style fleshy. Fruit 2–3-lobed and -seeded, rugose; subglobose with flattened top, ·4–·5″ diam.

In marshes, gregarious. Mals of Puri! Fl. April–May. Fr. r.s.
Root creeping, woody. Stems much polished, green. Leaves with a short petiole ·2–·25″ long, very finely nerved, sometimes pubescent. Sheath produced into a short ligule. There is a curious hard bracteole at the base of the pedicel, ·08″ long, subulate and angular when dry. This does not appear to have been mentioned in works consulted.
Mats are made from the split stems.

2. PHRYNIUM, *Willd.*

Herbs with creeping rootstock. Stem sometimes with a single terminal broad leaf and (in our species) a lateral dense head or spike of small or mod.-sized flowers (sometimes radical in other species). Tube of hypanthium elongate bearing linear-oblong spreading petals, the staminal-tube further elongated with unequal petaloid segments. Lateral staminode entire or 3-fid, labellum broad, transversely ridged within. Stamen narrow. Ovary 3-celled, style adnate below to the staminal tube, free portion hooked. Ovules 1 in each cell. Fruit globose or oblong indehiscent or finally dehiscent with 1–3 large seeds. Aril short fleshy. Embryo curved in a horse-shoe round a central canal in the perisperm (according to *Petersen* the perisperm canal is forked below the embryo).

Bracts of inflorescence with a hardened entire tip, petals white, shorter than the tube . . . . . 1. *parviflorum.*
Bracts of inflorescence with a bristly tip. Petals purple, longer than the tube . . . . . 2. *capitatum.*

1. P. parviflorum, *Roxb.* Runkona, *Khond.*

An erect usually gregarious herb with slender stem 2–5 ft. high from a tuberous rhizome, bearing single terminal large oblong or ovate-oblong leaf 12″ by 6″ to 20″ by 8″, shining both sides, shortly cuspidate. Flowers small white, the staminodes tipped with yellow, aggregated into a sessile lateral head 1–2″ diam. near the top or middle of the stem. Fruit broadly oblong ·4–·5″ long, 1-seeded.

Wet jungles. Singbhum! Puri! Fl. July–Aug. Fr. Sept.–Feb.
Leaf base rounded and shortly produced on top of petiole. Petiole about 2″. Heads sometimes two together with lanceolate bracts cuspidate, as long as the corolla-tube.

2. P. capitatum, *Willd.*

Habit of the last but the bracts of the head have a scarious tip which breaks up into bristles. The flowers have purple petals and rose-coloured staminodes. Petals longer than the corolla-tube. Fruit usually 3-seeded and 3-sided.

Singbhum, along shady nalas! Fl. July–Aug.

The large American genus **Calathea** has short unbranched stems from the rhizome and often handsome leaves. The inflorescence is usually strobilate or capitate with closely imbricating usually spiral bracts and several flowers to each bract. Labellum broad usually emarginate. Cucullate staminode with inrolled margins. Lateral staminode 1, usually emarginate.

C. zebrina is a very beautiful plant with a crown of large velvety leaves 1–3 ft. long, shaded above with bands of darker and lighter green, and purple beneath. Often grown in grass green-houses. Native of Brazil.

3. MARANTA, *L.*

Herbs with usually branched stem. Leaves often very ornamental in colouring. Flowers pedicelled paired on a common pedicel, 2–4 pairs enclosed in each bract of a spike of opposite distichous bracts terminating the stem or its branches, proper pedicels of each flower unequal. Spikes sometimes panicled. Corolla-tube longer than the calyx. Two lateral staminodes petaloid, larger than the others. Cucullate staminode usually with broad curved ear. Fertile stamen with a free appendage. Ovary 1-celled, 1-ovuled.

An American genus of which several very beautiful foliaged plants are common in grass greenhouses and verandahs in India.

1. **M. arundinacea,** *L.* Arrowroot; West Indian Salop.

A branched herb 3–6 ft. high with creeping rootstock and fleshy cylindrical-obovoid tubers about the size of carrots, covered with pale scales which leave scars when they fall. Leaves ovate-oblong and up to 10″ by 4·5″ at base of stem, upper 4–6″ ovate-lanceolate to narrowly lanceolate with rounded or cuneate base. Inflorescence laxly 2-chotomously branched with ultimate branches 2-fld. Fls. white, ·7–1″ long, sepals ·5″.

Occasionally cultivated for the starch and sometimes seen as a pot plant in verandahs.

It is the source of the true arrowroot.

ORDER.—GYNANDRÆ.

FAM. 159. ORCHIDACEÆ.

Herbs terrestrial or epiphytic or sometimes scandent (by means of adventitious roots). Stems often thickened into one or a chain of pseudobulbs, the latter usually terminating the internodes of a sympodium. Inflorescence lateral or terminal. Flowers from minute to very large and showy, solitary or usually spicate or racemose, zygomorphic. Hypanthium adnate to the ovary and sometimes shortly produced above it, it or its pedicel usually twisted. Perianth superior, in two alternating whorls. Calyx of 3 sepals, 2 (superior, lateral) sometimes united and forming at their base a sac or spur (*mentum*), one median (inferior). Petals 3, one (the lip) dissimilar from the other 2 (merely referred to as "*petals*") and variously developed, normally superior and turned towards the axis, but by the torsion of the pedicel or hypanthium the orientation of the parts of the flower is usually reversed, the median sepal becomes dorsal and the lip anterior and turned towards the bract. Stamens and style united into a column, the top of which is usually shortly produced (towards the lip) into a beak or process (*rostellum*). Anthers one or 2 only, sessile or subsessile on the long or short column, on the other side of the floral axis to the lip, large, often opercular; pollen cohering

in each anther-cell into 1, 2, or 4 pollinia which are free or attached by pairs or fours to a viscus or gland, or to a stalk (*caudicle*) which terminates in a viscid gland; by means of the gland the pollinia become attached to the heads of insects and are withdrawn from their cells. Ovary inferior, 1- rarely 3-celled: stigma one or two viscid surfaces on the top or front or on lateral processes of the column below or between the anther or anthers. Seeds most minute and numerous, testa lax, embryo not differentiated.

All our species belong to the *Monandræ* with a single anther but species of *Cypripedium* with 2 anthers are often seen in cultivation.

I. Pollinia softly granular or sectile (in small masses), held together by viscid threads (genera 1–6):—
  A. Anther erect, neither opercular nor deciduous, with very short broad filament. Caudicles basal. Column very short or 0, rostellum small erect or 0:—
    Terrestrial. Caudicles lying in tubes of the anther-cells . . . . . 1. *Habenaria.*
  B. Anthers erect or inclined, but inverted, not deciduous, filament slender or very minute, caudicles 0 or apical. Leaves convolute in bud, not articulate on the sheath:—
    1. Terrestrial, with tuberous rhizomes, inflorescence at the apex of the year's (underground) shoot:—
      a. Anther lying on the elongate rostellum which shows a deep cleft (rostellum 2-fid) on removal of the pollinia:—
        i. Stigma single, anticous:—
          Lip saccate at base . . . . . 2. *Goodyera.*
          Lip neither saccate nor spurred at base . 3. *Spiranthes.*
        ii. Stigmas 2 lateral. Pollinia 2 bipartite.
          Lip saccate or cymbiform at the base, inferior . . . . . 4. *Zeuxine.*
      b. Anther erect with the apex usually resting in cup-shaped top of column. Rostellum not 2-fid:—
        Leaf one large plicate, following the flowers . 5. *Pogonia.*
    2. Scandent, sympodium with elongate internodes . 6. *Vanilla.*

II. Pollinia waxy 1–4 in each cell. Anther opercular, deciduous (genera 7 to end):—
  A. Terrestrial orchids (exc. *Oberonia*, *Pholidota* and *Thunia* in which inflorescence terminates the members of a sympodium) (genera 7–16):—
    1. Inflorescence terminating the successive sympodially connected shoots. Leaves not plicate:—
      a. Leaves equitant or conduplicate in bud:—
        i. L. equitant. Fls. very minute. Small epiphytes . . . . . 7. *Oberonia.*
        ii. L. not equitant. Flowers small, resupinate (lip dorsal):—
          Lip with basal appendage. Column very short . . . . . 8. *Microstylis.*
          Lip without basal or auricular appendages. Column long with wings or callosities . 9. *Liparis.*
      b. Epiphytes. Leaves convolute in bud:—
        Shoots pseudobulbous. Fl. small globose in the axils of distichous bracts . . . 10. *Pholidota.*
        Stems leafy not pseudobulbous. Fls. large . 11. *Thunia.*
    2. Inflorescence axillary or on special lateral shoots. Leaves plicate:—
      a. Pollinia 4 or 8, not attached to a gland of the rostellum:—
        Fls. large. Sep. and pet. spreading. Column long . . . . . 12. *Phajus.*

Fls. m.s. Sep. cohering and with large saccate mentum. Column short stout. Anthers 2-celled . . . . . 13. *Acanthephippium.*
Fls. rather small. Scape lateral, appearing before the leaves. Lat. sep. adnate to base of slender column. Anthers 4-celled . . 14. *Pachystoma.*

b. Pollinia 2 or 4 attached to a gland of the rostellum which is carried away with them when they are removed. Scape leafless. Underground stem a chain of tubers :—
Lip cymbiform, margins involute . . . 15. *Geodorum.*
Lip with saccate or shortly spurred base, lateral lobes erect embracing the column or 0 . . . . . 16. *Eulophia.*

B. Epiphytic orchids. Inflorescence never terminating sympodially connected shoots* (vegetative shoots often sympodially connected). Leaves never plicate (genera 17 to end) :—

1. Foliage shoots of limited apical growth, their basal parts forming a sympodium (rhizome), their upper parts free and usually swollen into pseudobulbs. Pollinia 4 or 8 not attached to a gland or process of the rostellum :—

a. Upper parts of each annual shoot with several nodes (hence ringed, jointed or scarred after fall of leaves). Stems elongate and pseudobulbous :—
Fls. usually large and bright-coloured, not woolly. Pollinia 4 . . . . . 17. *Dendrobium.*
Fls. not large or bright-cold., often woolly. Pollinia 8 . . . . . 18. *Eria.*

b. Upper part of each annual limb of the sympodium with only one node (pseudobulb not ringed). Pollinia 4 :—
Sepals subequal . . . . . 19. *Bulbophyllum.*
Lateral sepals very long and exceeding the median . . . . . 20. *Cirrhopetalum.*

2. Foliage shoots of unlimited apical growth, monopodial, not pseudobulbous. Leaves strap-shaped or linear, articulate on the sheath. Inflorescence lateral, usually many-fld. Gland or process of rostellum carried away with the pollinia :—

a. Lip not spurred :—
i. Column without a foot (or foot very short in *Vanda*) :—
L. terete. Column winged . . . 21. *Luisia.*
L. thick linear. Column short stout. Lip saccate at base . . . . . 22. *Rhynchostylis.*
ii. Column with a foot, lateral sepals forming a mentum with it, column winged . 23. *Doritis.*

b. Lip spurred or prominently saccate (see also 22) :—
i. Lip saccate or spurred at the base :—
Spur with longitudinal septum. Fls. small 24. *Sarcanthus.*
Spur with a transverse lamella or callus. Fls. small . . . . . 25. *Cleisostoma.*
Spur not divided. Fls. small, stipes of pollinia slender . . . . . 26. *Saccolabium.*
Spur not divided. Fls. usually large. Stipes of pollinia broad . . . 27. *Vanda.*
ii. Lip with an ascending or recurved hollow spur under the blade . . . . 28. *Aerides.*

* Often from the uppermost leaf axils or nodes of aërial shoots which have lost their leaves. Apparently terminal in *Dendrobium*, spp. 1–3.

1. HABENARIA, *Willd.*

Terrestrial tuberous herbs with 2–many leaves with sheathing bases. Flowers large or mod.-sized, more rarely small, white, green or yellow. Lateral sepals mostly spreading or reflexed, dorsal sometimes connate with the petals. Petals simple to 2-partite with often filiform segments. Lip various, usually 3-lobed, always spurred at the base. Column short with usually small erect 3-lobed rostellum, midlobe often minute between the cells of the anther or 0. Anther erect adnate to the column with cells parallel or divergent below and their bases often produced into long or short grooves or tubes in which the caudicles of the pollinia lie; pollinia granular with short or elongate basal caudicles and an exposed gland. Stigma 2-lobed or 2 more or less developed papillose often clavate processes.

(In *H. Susannæ* the stigma is a single viscid area, and on this account it is sometimes included in a separate genus, *Platanthera*, *Rich.* The last four species are sometimes placed in a separate genus, *Peristylus*.)

I. Flowers ·5″ diam. or over with lateral sepals free spreading reflexed or deflexed. Spur elongate (Spp. 1–14):—
  A. Petals 2-fid or 2-partite. Lip 3-partite. Stem leafy from base upwards:—
    Sepals with filiform tips . . . . . 1. *stenopetala.*
    Sepals acute . . . . . 2. *digitata.*
  B. Petals entire (Spp. 3–14):—
    1. Lip 3-lobed or -partite (Spp. 3–13):—
      a. Side-lobes of lip palmately lacerate or pectinate:—
        Stem tall leafy with large white flowers . 3. *Susannæ.*
      b. Side-lobes of lip entire or only slightly toothed, broad (*cp. c*). Fls. white (Spp. 4–8):—
        i. Leaves appressed to the ground:—
          † Lip not or hardly longer than lateral sepals:—
            L. 2, sessile orbicular or broadly elliptic. Sep. 6–7-nerved . . . . . 4. *platyphylla.*
          †† Lip much longer than lateral sepals. L. more than 2:—
            Fls. (with ovary) 1″ or less. Spur ·75–1·5″ 5. *plantaginea.*
            Fls. (with ovary) 1·5″ or more. Spur 2–4″ 6. *longicalcarata.*
        ii. Leaves clothing the stem:—
          L. linear. Sepals ·17″ long. Lip ·5–·7″ broad . . . . . 7. *longifolia.*
          L. lanc.-oblong. Sep. ·5″ long. Lip 1″ broad . . . . . 8. *triflora.*
      c. Side-lobes of lip entire, filiform:—
        i. Anther-cells with long tubes:—
          Tall, leafy. Fls. white, lip with filiform segments . . . . . 9. *commelinifolia.*
        ii. Anther-cells with short tubes:—
          † L. clustered, mostly above base of stem:—
            Fls. green. Sep. ·15–·17″. Spur longer than ovary . . . . . 10. *furcifera.*
            Fls. green. Sep. ·12–·125″. Spur shorter than ovary . . . . . 11. *affinis.*
            Fls. yellow. Sep. ·25″. Leaf margined 12. *marginata.*
          †† Leaves 2 only, nerveless, appressed to ground . . . . . 13. *diphylla.*
    2. Lip entire, linear. Stem leafy . . . 14. *stenantha.*

II. Flowers very small* (exc. in 15 and sometimes 18), lateral sepals erect or ascending and more or less connivent. Spur very short, often sub-globose :—
A. Lip entire, broad. Spur short stout ·1″ long only . 15. *galeandra.*
B. Lip 3-fid or -lobed :—
1. Spur elongate-clavate, ·15″. Fls. under ·2″ diam. . . . . 16. *Stocksii.*
2. Spur subglobose, ·1″ long or less :—
a. Rather stout. Lat.-sepals ·2–·25″ :—
Lip-lobes broad sub-obtuse or obtuse. Fls. sub-secund. Perianth ·15″ long . . 17. *goodyeroides.*
Lip-lobes narrowly lanceolate. Fls. not secund. Perianth ·3–·7″ long . . 18. *constricta.*
b. Slender. Fls. ·2–·25″ diam. Lat. sep. ·12″ . 19. *Lawii.*

1. **H. stenopetala,** *Lindl.*

A stout erect orchid 1–3·5 ft. high, basal third of stem clothed with closely-fitting sheaths. Leaves several, oblong-lanceolate or ovate-lanceolate, acute, undulate, from a broad amplexicaul base, 3–8″ by 1·25–2·75″. Flowers crowded about ·7–1″ diam., pale green except the lip which is brown, in a raceme 4–9″ long, peduncle with lanceolate acuminate bracts passing into leaves at base of scape. Sepals with filiform tips ·25–·5″ long, 3-nerved. Petals 2-partite, segments slender equal or the lower shorter (rarely obsolete). Lip 3-partite, segments filiform, spur equalling the ovary, slender. Anther-cells narrow with tubes nearly as long as the cells. Stigmatic processes clavate elongate. Capsule linear-oblong, ·5–·7″.

Chota Nagpur, Singbhum, *Clarke* (*fide F.B.I.*). I have been unable to find *Clarke's* specimen. Fl. Aug.–Oct.

2. **H. digitata,** *Lindl.*

An erect ground orchid with tall leafy stem 1–2 ft. high, lowest leaves reduced to infundibular sheaths. Leaves elliptic-lanceolate acute or acuminate, 2–4″ long, sessile on the sheath, papillosely ciliolate. Raceme or spike about 5″ rather laxly several-flowered with greenish or green and white flowers with a resemblance to insects. Lateral sepals ·3–·35″ somewhat obliquely ovate, acute, without filiform tips, dorsal shorter very concave, petals 2-partite nearly to the base with linear segments, upper broader erect recurved about ·25–·3″ long, lower segment spreading and often recurved ; lip 3-partite with linear segments, centre segment straight nearly ·5″ long, lateral segments more filiform often decurved longer or usually shorter, spur ·6″ subclavate, sometimes inflated, with an erect ligule at the mouth.

Manbhum, near Parasnath ! Gangpur (var. *foliosa*), *Cardon* ! Fl. July–Sept.

Tubers small, about 1″ diam., many fleshy roots from the stem above the tuber. Leaves variable according to the *F.B.I.*, from ovate or orbicular to ovate-oblong or lanceolate and rarely narrowed into a short petiole. Bracts lanceolate ·8–1″ (often almost foliaceous and exceeding the flowers, *F.B.I.*), pedicels very short (the flowers are practically sessile in my specimens). Anther-cells parallel, tubes short upcurved, glands of pollinia minute. Stigmatic processes clavate, rostellum erect, triangular. Capsule ·5″, fusiform with thick ribs. The flowers sometimes have a disgusting odour.

Var. **foliosa** is described as smaller and only 6–12″ high with shorter broader imbricating leaves and dense-fld. raceme, bracts shorter and segments of lip filiform. My Manbhum specimen approaches the variety in the bracts being shorter than the ·9″ long ovary and in the filiform lip segments.

* See also cleistogamous form of *H. diphylla.*

3. H. Susannæ, *Br.*

A very striking ground orchid 2–3 ft. high with robust leafy stem, elliptic-oblong or lower ovate-oblong leaves 3–8″ long and few large white flowers 2·5–4″ diam. with deep brown lip and lacerate side-lobes, in a few-fld. raceme.

Not unfrequent in thin forest. Singbhum! Palamau! Hazaribagh, *Clarke*! Gangpur, *Cardon*! Fl. Sept.–Oct.

Tubers 3–4″ long contracted into a large sheathing base, subacute, many-nerved. Bracts leafy. Flowers subsessile with an elongate ovary, fragrant. Lateral sepals spreading oblong-lanceolate (subquadrately oblong, *F.B.I.*), dorsal sepal very broad obovate or rhomboid, rounded. Petals linear. Lip with digitately pectinate broad side-lobes and broadly linear midlobe dilated downwards, spur 4·5–6″ long or twice as long as the ovary. Anther very broad and large, cells slightly divergent, tubes adnate to the sides of the column; pollinia linear, about as long as their caudicle. *Hooker* (*F.B.I.*) adds: "This is a true *Platanthera*, in wanting the produced stigmatic processes, and the obscure rostellum, which is marked by a triangular line only."

4. H. platyphylla, *Spreng.*

A pretty ground orchid 8–12″ high with a pair (rarely 3) of very dark green broadly elliptic or orbicular leaves 1·5–3″ long appressed to the ground, and pure white flowers in rather dense spikes ·5–·6″ diam. but variable in size. Lateral sepals spreading or drooping, ·22–·4″ long, somewhat obliquely ovate-oblong, broad, 6–7-nerved, obtuse, dorsal sepal erect shorter elliptic concave; petals linear, shorter than the dorsal sepal and erect with it; lip shorter than the sepals or equalling them with a very slenderly lanceolate often decurved midlobe and 2 short petaloid, broader rounded side-lobes not half the whole length of lip, spur very long, ·7–1·5″, funnel-shaped at its base and slenderly clavate towards its apex. Tubes of anther like 2 horns, very long (up to ·07″).

Clayey ground on banks, especially near streams in the forest. Singbhum! Fl. Aug.–Sept.

Stem between the leaves and the tubers clothed with sheaths. Leaves always 2 wherever I have seen it (ranging from Chota Nagpur to Chanda in the Central Provinces), but 3–6 according to the *F.B.I.*! Sheaths on the scape narrowly lanceolate-acuminate, erect. Spike 2–4″ long, round-topped. Flowers fragrant. Ovary elongate long-beaked sessile, only one-half to three-fourths as long as the spur. Spur with a short tooth at its mouth.

5. H. plantaginea, *Lindl.*

A pretty ground orchid with habit of *platyphylla* but always with more than 2 leaves (usually 5–7) which are oblong or elliptic-oblong 1–3″ long, rarely 4·5 by 1·5″ (3–6″ long, *F.B.I.*). Scape slender 8–12″ with a rather lax spike of white flowers. Lateral sepals spreading or erect dimidiate-ovate or falcate, ·2–·3″ (·17″, *F.B.I.*), 3–4-nerved, dorsal concave erect rather shorter than the lateral, elliptic-ovate 3-nerved; petals linear-lanceolate, erect, about equalling the dorsal sepal, 1-nerved; lip *much larger* than the sepals ·4″ long and flabelliformly ·4–·5″ broad with 2 large semi-ovate or falcately oblong lateral lobes and equally long linear entire midlobe; spur very slender, usually upcurved, 1–1·5″ long, scarcely widened either above or below. Anther-tubes short upcurved.

Similar localities with *H. platyphylla*, but more common. Singbhum! Man-

bhum, *Clarke*, *Wood*! West Bengal and Behar, *Kurz*! Gangpur, *Cardon*! Sarguja, *Cardon*! Parasnath (Hazaribagh), *Clarke*! Fl. Aug.–Oct.

Stem between the tubers and the leaves very short, clothed with sheaths. Sheaths on the scape numerous, slender, acuminate, erect. Spike 2–3″ rarely 5″ in robust specimens, on a peduncle 10″; flowers sometimes sub-secund; perianth minutely puberulous. Ovary beaked, about half as long as spur, slender, bracts about half as long as ovary. Anther rather broad, stigmatic processes large, clavate. Capsule ·75″, fusiform with short slender beak. *Sir J. D. Hooker* remarks: "In this species the caudicles of the pollinia are at first inserted in the hollow of a single concave 2-lipped or incurved gland of a lanceolate form, which afterwards splits longitudinally, each pollinium carrying away half."

6. H. longicalcarata, *A. Rich.*

Habit of *H. plantaginea*, 10–18″ high with narrowly oblong or lanceolate leaves 2–4″ long. Flowers fewer and larger, 1·5″ or more (with the slender 1″ long beaked ovary), pedicelled, with sheathing bracts shorter than the ovary. Sepals ·5″ long, 3-nerved, obtuse. Petals oblong-lanceolate acuminate. Lip ·75–1″, side-lobes dimidiate-ovate acuminate fimbriate or toothed. Spur 2–4″ long. Anther very broad, tubes as long as the cells, pollinia narrowly pyriform shorter than their slender caudicles which are narrowly winged on one side.

Gangpur, *Cardon*! Fl. Aug.

7. H. longifolia, *Ham.*

Height 15–20″. Leaves clothing the stem, almost grass-like, 3–6″ long below and ·1–·2″ wide, shorter upwards. Flowers white ·9–1″ long (with the ovary) in few- and lax-fld. spikes 2–3″ long with slender bracts longer than the slender beaked ovaries. Sepals ·17″ long, oblong-lanceolate, 3-nerved, median smaller, petals gibbously ovate equalling the median sepal. Lip ·5–·7″ long and broad, with large hatchet-shaped side-lobes and narrow linear-subulate shorter centre-lobe. Spur slender, twice as long as the ovary.

Darbhanga (Pusa), *Prain*! Bhagulpur (Nathpur, *Ham.*).* Fl. Sept.

8. H. triflora, *Don.*

A beautiful ground orchid about 1 foot high with the stem clothed to the top with leaves or leaf-like bracts sheathing at the base, and with 1–3 large pure white flowers with suberect sepals ·5″ long forming a hood, and the lip about 1″ across with oblong-obovate or hatchet-shaped side-lobes and shorter linear acute midlobe. Petals small linear-subulate. Spur 1″ to over 2″ long, the slightly thickened or swollen tip usually concealed in the bracts.

Muddy banks of streams in the forest, Singbhum! Ranchi (a fruiting specimen only), *Clarke*! Fl. Aug.–Sept.

Leaves 1–3″, lanceolate-oblong, lower embracing the stem, gradually smaller from base to top of the stem, where they pass into the bracts which embrace the ovaries, upper acuminate. Flowers shortly pedicelled, lip sessile on the mouth of the spur and there 2-gibbous, side lobes crenulate (according to *F.B.I.*, entire in my specimen), spur very slender as long as the ovary or longer, mouth funnel shaped. Anther-cells on each side of the very broad quadrate truncate anther, bases produced into short free tubes, glands minute. "Staminodes prominent" (*F.B.I.*). Capsule ·5″ long.

* The *F.B.I.* says Nathpur, in Nepal; *Prain* says Nathpur, in Purneah; but see Appendix I.

9. H. commelinifolia, *Wall.*

A ground orchid 1·5–2·5 ft. high with a robust leafy stem with oblong to oblong-lanceolate leaves 3–7″ long, passing into lanceolate sheaths above and numerous white scentless flowers ·5–·75″ diam., well marked by the deflexed gibbous lateral sepals ·4″ long with a small beak above (at the apex), smaller orbicular median hooded sepal and by the linear lip with two very slender filiform lateral diverging segments; spur very long, reaching 2·5″ and doubly curved, with a funnel-shaped mouth and slightly inflated apex.

Open ground in the forests, common. Singbhum! West Bengal and Behar, *Kurz*! Gyra, *T. Thomson*! Plains of Behar, *T. Thomson*! Singbhum! Manbhum! Hazaribagh, *Clarke*! Ranchi, *Clarke*, *Prain*! Fl. Sept.

Leaves with a translucent white edge, sometimes conduplicate. Spike 4–8″ long. Filiform lateral segments of lip ·7–1″ long. Tubes of the anthers very long projecting forward; staminodes seated on the long arms of the column. Ovary with its long filiform beak 1·2–1·5″, upper two-thirds filiform. Capsule ·5″ fusiform, beaked.

10. H. furcifera, *Lindl.*

A ground orchid 12–18″ high with 3–5 leaves 3–6″ long clustered towards the base of the stem, which is furnished with 3–4 bract-leaves above and a rather lax spike 4–6″ long of green flowers ·6–·7″. Sepals spreading or reflexed subequal in length ·15–·17″, dorsal concave deltoid-ovate obtuse 3–4-nerved, lateral dimidiate-ovate or falcately oblong-lanceolate about half breadth of dorsal, subacute. Lip trifurcate, ·3″, side-segments filiform, nearly twice as long as the linear mid-lobe, spur longer than the ·5″ curved ovary, very slender, involute. Staminodes prominent as large tubercles.

Under dense shade in the forest. Singbhum! Ranchi (Ichadagh)! Gangpur, *Cardon*! Sarguja, *Cardon*! Fl. Aug.–Sept.

Tubers 2 ovoid about 1″ long. Base of stem covered with sheaths below the cluster of leaves. L. variable in shape mostly narrowly elliptic or ell.-oblong, some oblanceolate, elliptic or obovate, acute or shortly acuminate, longer narrowed at base but without petiole, uppermost sometimes quite amplexicaul. Spike narrow, cylindric, with lanceolate acuminate bract about as long as the beaked ovary. Petals slightly broader than the sepals, ·08″ wide, oblong obtuse (or retuse, *F.B.I.*), 2-nerved. Anther rather small, tubes upcurved. Stigmatic processes short. Capsule ·5″, fusiform, turgid, decurved, with thick ribs and beak one-fourth as long as the body.

11. H. affinis, *Wight.*

Closely resembling *H. furcifera*. Leaves elliptic-lanceolate acuminate 4–6″ by 2–2·5″, hardly petioled. Spike 4–10″ of green flowers about the size or a little larger than those of *furcifera*. Lip 3-partite nearly twice as long as the ·2–·25″ long sepals, middle lobe narrowly lanceolate, side-lobes linear or linear-subulate, rather shorter (or longer, *F.B.I.*) than the mid-lobe. Spur incurved or even hooked, half or rather more than half as long as the ovary.

Singbhum, *Clarke*, *fide F.B.I.* But *Clarke's* specimens are in fruit, and I rather think they are *H. furcifera*, especially as this is frequent in Singbhum and I have never found undoubted *affinis*.

12. H. marginata, *Coleb.*

Rather a dwarf orchid 6–12″ high. Leaves several in lower fourth or near base of stem, with a white or yellowish line round the margin,

oblong or narrowly oblong, 3–4″ long. Spike 2–4″ long of yellow flowers or lip yellow and remainder yellowish-green (in our plant), curved, ·8″ long (with the ovary). Median sepal broadly ovate, nearly ·25″, lateral oblong-lanceolate, as long, 3–5-nerved. Lip longer 3-partite, side-lobes slender, longer than the linear obtuse central lobe. Spur stout equalling or shorter than the curved ovary, inflated clavate or fusiform below the middle.

Rajmahal Hills, *Kurz*! Manbhum: Tundi Hills, *Campbell*! Jonah, *Prain*! Jaspur, *Cardon*! Fl. Sept.–Oct.

Collett describes the (hill) plant as "very pretty with bright yellow flowers," *Robertson* as "a small ground orchid with orange-yellow flowers, rather fleshy." Sheaths on the scape many erect, lanceolate. Bracts ciliolate. Petals ovate falcate, 2-nerved. Capsule ·5″, fusiform, curved, obscurely beaked.

13. H. diphylla, *Dalz.*

A dwarf terrestrial orchid 6–10″ high with a single pair of orbicular or elliptic cordate-based nerveless blue-green leaves ·75–2″ long, closely adpressed to the ground. Flowers white and greenish ·5″ diam. (or only ·25″ in the cleistogamous form), in a narrow spike 2–4″ long with lanceolate acuminate appressed bracts ·25″ long. Sepals subequal, lateral spreading white or greenish oblong 3-nerved, dorsal sepal green ovate conniving with the smaller petals. Lip 3-partite, much longer (about ·25″ in the cleistogamous form), with a ligulate mid-lobe and 2 short linear fleshy green side-lobes or (*fide F.B.I.*) the side-lobes longer. Ovary and spur about ·5″.

On damp clay. Singbhum! Jaspur, *Cardon*! Fl. Sept.

Root of 2 tubers with fleshy fibres from base of stem. L. punctulate when fresh unequal. Scape with many small sheaths below the spike. Petals linear. Anther broad, cells diverging, tubes very short. Ovary inflated acute, scarcely beaked, rostellum obscure, stigmatic processes clavate adnate to the mouth of the spur.

14. H. stenantha, *Hook. f.*

A single specimen collected by *Rev. Cardon* in Chota Nagpur was so-named in the *Calcutta Bot. Gard.*, but *H. stenantha* is a plant of the temperate Himalaya and confirmation is necessary. It might be *H. latilabris*, *Hook. f.*, which has been collected in Central India. The sepals are linear deflexed and the petals of *stenantha* are erect and linear, whereas those of *latilabris* are more or less ovate. It flowered in Aug. in the Hort. Bot. Cal., but I did not see it in flower.

15. H. galeandra, *Benth.* Syn. Platenthera obcordata, *Lindl.*, in *Wall. Cat.* No. 7050.

A distinct-looking species 6–10″ high with a cluster of 3–4 ellipsoid tubers and a very leafy stem, the leaves ovate to oblong and the largest only about 2″ on the lower part of the stem, whence they are gradually reduced upwards and imperceptibly pass into the bracts. Spike 2–4″ long, bracts oblong-ovate to lanceolate, lower much longer than the flowers. Flowers pale purple, perianth ·2–·25″ long and about ·5″ diam. with ovate dorsal sepal, falcately lanceolate lateral sepals, rather narrower obtuse petals, cuneiformly obovate or obcordate lip and a short stout cylindric spur ·1″ long only.

Chota Nagpur, *Wood* (without precise locality). Fl. July.

16. H. Stocksii, *Hook. f.*

A very slender plant 8–10″ high with oblong-ellipsoid tuber and the leaves occupying 2–3″ of the stem near the middle. Leaves elliptic but acuminate both ends, 1·5–2·5″, rather prominently 3-nerved. Flowers yellowish, as small as those of *Lawii* but for the spur, in a rather lax spike 3–5″ long with the slender curved almost beaked ovary exceeding the bract. Lip equally 3-lobed with obtuse oblong, or central ovate, lobes; spur elongate-clavate, ·15″.

Parasnath, *C.B.C.*! Twice collected on Parasnath. Fl. Oct.

If this is *Stocksii* the distribution is peculiar, the other specimens being from the Concan and Maisor. *Hooker* describes *Stocksii* as with strict twisted spike and secund flowers (ours are subsecund), bracts longer than the ovaries, lateral sepals linear-oblong, dorsal elliptic, petals larger ovate obtuse fleshy, lip shorter than the sepals obtusely 3-fid, spur as long as the sepals, subclavate, and he remarks very like *H. Lawii*, but spur quite different.

The specimens agree fairly with this description where not otherwise specified above.

17. H. goodyeroides, *Don.* Syn. Peristylus goodyeroides, *Lindl.*

Usually a robust plant 2 ft. high with the leaves occupying 1–2″ of the middle of the stem, elliptic-oblong or elliptic 3–4″ long, acute. Spike dense 4–6″ long with lanceolate bracts equalling or exceeding the ·3″ long ovary. Perianth ·3–·4″ diam., yellowish-green, lateral sepals ·2–·25″ linear- or ovate-oblong obtuse, petals gibbously ovate, lip as long as the sepals, 3-fid with oblong obtuse or rounded lobes or mid-lobe ovate, and minute stipitate bulbous spur.

Parasnath, *T. Thoms., C. B. Clarke*! Fl. r.s. Fr. Sept.–Oct.

The Parasnath plant is only 12″ high with about 6 leaves near the centre of the stem, and sheaths below. Tuber oblong. Capsule ·4″ stout oblong (fusiform, *F.B.I.*).

18. H. constricta, *Hook. f.*

A ground orchid 18″–2 ft. high with rather stout stem clothed with large leaf-sheaths inflated at the mouth below the cluster of elliptic leaves, which are 3–5″ long and aggregated near the middle of the stem. Flowers yellowish or greenish or white in narrow dense spikes 4–7″ long with narrow acuminate puberulous bracts ·5–·6″ long. Lateral sepals linear-lanceolate ·25″,* dorsal lanceolate concave, somewhat shorter. Petals white ·32″ nearly oblong (ovate-oblong, *F.B.I.*), obtuse, 3-nerved. Lip as long or slightly exceeding the petals, with narrow base and 3-furcate from about the middle with the side-lobes linear-lanceolate and slightly longer than the lanceolate mid-lobe (lobes of lip very variable, *F.B.I.*), spur very short globosely inflated, ·08″ long, greenish.

Open jungles, Manbhum (not far from Parasnath)! Also Chota Nagpur (without precise locality), *Cardon*! Fl. June–July.

Leaves tapering at the amplexicaul base, one sometimes inserted an inch above the others, nerves many with short transverse nervules, acute or sub-acuminate. Bracts 1-nerved. Flowers about as long as their bracts, puberulous in my specimens. Staminodes, 2 calli. Anther-cells with short tubes, pollinia clavate, caudicles short with large glands, rostellum 2-fid, erect, stigmatic processes clavate.

* Up to ·5″ or even ·7″ in specimens outside our area.

19. **H. Lawii**, *Hook. f.*

A ground orchid 6–12″ high with 3–4 erecto-patent elliptic, oblong or lanceolate leaves 2·5–5″ long above the middle of the stem and a narrow spike 2–4″ long densely clothed with linear acuminate bracts below the flowers, but often with buds or abortive flowers in their axils. Flowers very small sub-globose white ·2–·22″ diam. Lateral sepals oblong or linear-oblong ·1–·12″ long, spreading, tip rounded, margin incurved; dorsal ·13″ broadly ovate slightly concave, forming a hood with the petals. Lip scarcely longer, concave, 3-lobed with the central lobe larger than the lateral, lobes rounded, spur very short succulent bulbous. Anther without tubes.

Ranchi, on Ichadagh, 2500 ft. ! Parasnath, *Clarke* ! Fl. Aug.–Sept.
Tubers 2, ovoid, about 1″ long. Stem sometimes 6″ to the first leaf, clothed below with inflated leaf sheaths or uppermost sheath with a small amplexicaul leaf, leaves acute or shortly acuminate narrowed into a very short petiole-like base. Bracts ·3″ slightly exceeding the twisted ovary. Lateral sepals ascending (according to *F.B.I.*, spreading in my specimens when fresh). Petals obovate, slightly winged anteriorly, retuse or rounded. Lip described as 3-fid in *F.B.I.* Column hardly any with short acute rostellum. Anther-cells parallel, pollen granular, pollinia with a small elastic caudicle (caudicle 0, *F.B.I.*), and a round hyaline gland. Ovary slender twisted shorter than the ·3–·5″-long bracts.

2. GOODYERA, *Br.*

Ground orchids with short leafy stems, sometimes elongate and creeping below, and small flowers in terminal, sometimes twisted spikes. Sepals subequal, dorsal erect concave forming a hood with the narrower petals conniving but free; lateral erect or spreading, covering the sac of the lip or not. Lip inferior, sessile at the base of the column, entire, or with small side-lobes, cymbiform or subsaccate, sac sometimes with filiform appendages or setæ within. Column cylindric or with cupular top at the back of which the anther is hinged with its base included, anther-cells distinct, rostellum erect 2-fid, at least after removal of the pollinia, which are pendulous from a gland at its apex, pollen finely granular. Stigma occupying a single broad anticous surface below the rostellum.

1. **G. procera**, *Hook.*

Erect 12–18″ high with inflated leaf sheaths at base. Leaves lanceolate 4–6″ long by ·8–1·5″ broad, petioled, flat. Spikes 3–6″ (excluding peduncle), dense, of minute globose white flowers with perianth ·1–·12″ long. Lip about three-fourths as long as the sepals with a globose saccate base and very short erect side-lobes and minute tongue-shaped front lobe, palate with 2 large calli and sac softly setose within.

Growing on rocks in the middle of streams, Singbhum ! Fl. March–April.
Leaves with 6–8 parallel nerves each side of midrib, but one sometimes stronger than the others, base tapering to the petiole. Bracts ·3″ finely acuminate, sometimes thinly pubescent as are the rhachis and ovary, which is ·2″ long. Capsule ·3″, fusiform.

3. SPIRANTHES, *Rich.*

Terrestrial herbs with fibrous or tuberous roots and leafy stem, or flowering stem leafless. Leaves various, usually narrow. Flowers

small secund in often twisted spikes. Sepals subequal free or more or less cohering with the petals in an erect hood, lateral gibbous at the base. Lip sessile or clawed, erect, entire or 3-lobed, base concave, palate callous or lamellate. Column short, terete, base often decurrent on the ovary. Stigma anticous broad, rostellum erect obtuse or elongate and 2-fid; anther erect 2-celled as long as the rostellum; pollinia pendulous from the gland of the rostellum, pollen powdery.

1. S. australis, *Lindl.*

A graceful little orchid with several slender fascicled tubers; 3–15″ high with linear-lanceolate or narrowly oblong leaves 1–4″ by ·3–·5″ principally near the base of the stem, upper passing into the linear acuminate bracts. Flowers white and greenish ·12–·15″ (excluding the ·08–·1″ usually papillose or pubescent ovary) long, spirally arranged (by twisting of the rhachis) on a pubescent scape with ovate or lanceolate bracts exceeding the ovary. Perianth very oblique to ovary, median sepal adnate to petals, lateral obliquely lanceolate 1-nerved, parallel to lip which is yellowish and saccate at base with a pair of large glands on margin of sac, blade slightly 3-lobed and crenulate or crisped, pilose above.

Extends from Garhwal to the Duars in grassy places !, and therefore probably in our Northern area, having been found each side of it. Fl. March–April.

4. ZEUXINE, *Lindl.*

Terrestrial herbs with stem creeping below and fleshy roots. Leaves narrow or broad. Flowers small in sometimes secund spikes. Sepals subequal or median rather broader and forming with the petals a hood, lateral free. Lip inferior, adnate to the base of the column, sessile, cymbiform or saccate with an entire 2-lobed or 2-winged terminal lobe, sac usually with calli or spurs near the base within. Column very short, 2-keeled or -winged in front; stigmatic lobes 2 marginal, distant, anther membranous, cells contiguous or diverging at base; pollinia pyriform, attached by an oblong gland to the erect rostellum with often an intermediate appendage or a linear caudicle.

A. Leaves linear :—
  Median sepal ·2–·25″, lip with fleshy terminal lobes, anther broad ovate cuspidate . . . . . 1. *sulcata.*
  Median sepal ·1″, lip with 2 thin lateral wings, anther narrow sagittate . . . . . 2. *membranacea.*
B. Leaves broad, lip 2-winged at apex . . . . . 3. *affinis.*

1. Z. sulcata, *Lindl.*

A small orchid 2–6″ high, or in some districts up to 12″, with fleshy roots and erect stem sometimes from a creeping base, clothed closely with erect grass-like leaves and terminating in a stout pyramidal spike of small white flowers ·2–·25″ long (excluding the ovary).

In sandy and gravelly soil. Bettiah, *Hieronymus* ! Purneah ! Monghyr, *Lockwood* ! Manbhum, "marshy ground," *Ball* ! Singbhum ! Not uncommon. Fl. Jan.–Feb.

Lower part of stem with short annular sheaths. Leaves linear acuminate, 1–2″ long. Spike 1–2″, dense, bracts erect, lanceolate acuminate, ·25–·5″, 1-nerved. Perianth oblique on the ·2″ long ellipsoid glabrous ovary, median sepal gibbous ·22″ loosely connate with the petals, lateral sepals oblong to lanceolate obtuse ·18″ free 2–3-nerved. Lip green fleshy linguiform with upturned sides, side-lobes slightly elevated only, a slight constriction at base of terminal lobe which has 2 fleshy upturned lobules, obtuse or retuse. Filament very short broad hyaline bearing a hinged red broadly ovate apiculate 2-celled anther, pollinia attached to a common membranous process of the oblique rostellum, consisting of numerous small waxy masses held together by viscid threads, rostellum 2-fid.

The *F.B.I.* says that the flowers are white, yellow or very pale rose and lip yellow. The short claw at base of terminal lobe of lip is described as pubescent; it and the side-lobes are rather papillose in my specimens. Being a wide-spread Indian orchid, it is probably variable, but the *F.B.I.* has united with *Z. sulcata* the following species, which is quite distinct.

2. **Z. membranacea,** *Lindley.* Syn. Z. sulcata, *F.B.I.* (in part).

A dwarf orchid 3–15″ high with habit of *Z. sulcata* and somewhat similar leaves. Spike ·5–2″ on peduncles 2–4″ long of white flowers ·15–·18″ long (without the ovary). Perianth nearly straight on the ovary which is pubescent and obconic. Lateral sepals ovate acuminate ·1″ free, indistinctly 1-nerved. Median sepal ·15″ conniving but not connate with the petals into a hood, ovate, obtuse, 1-nerved. Lip contracted between the orbicular saccate hypochile and the thin transversely oblong expanded flat ·07″ broad epichile which is apiculate between the wings, side-lobes 0. Rostellum deeply 2-fid. Filament very short bearing an erect sub-sagittate anther.

Growing in grass. Purneah! Fl. Dec.–Jan. Distrib. Purneah to Burmah.

Lower part of stem with short sheaths. Leaves linear or linear-oblanceolate acute or acuminate, 1–2″ long. Bracts lanceolate slightly exceeding the flowers. Median sepal not gibbous, ·15″. Perianth not pubescent nor papillose. Capsule ·2″ somewhat obovoid-oblong, ribbed.

Quite distinct from *Z. sulcata,* with which it has been united.

3. **Z. affinis,** *Benth.*

A pretty little orchid 8–15″ high ascending from a creeping base, which and lower parts of stem are furnished with membranous sheaths or leaf-bases. Leaves several, ovate-oblong, 1–1·7″ sessile or with short petioles on the inflated broad hyaline sheaths. Flowers white in thinly pubescent spikes 1–3″ long with perianth ·15–·2″ long very oblique on the erect thinly pubescent ovary. Lip saccate with 2 white hatchet-shaped wings each about ·12″. Bracts membranous, 3-nerved, mostly shorter than the narrow ovaries.

Sikkim Tarai and Duars and probably in Purneah! Fl. Feb.–March.

5. POGONIA, *Griff.*

(Section *Nervilia,* Gaud. Gen.)

Terrestrial tuberous herbs with a single remarkable leaf, being orbicular or broadly ovate with cordate base and strongly plicate, appearing after the flowers. Flowers small or mod.-sized, often green, solitary, few or many, horizontal or pendulous in a raceme. Sepals and petals subequal, narrow, connivent or spreading. Lip

adnate to the base of the column, sessile or sub-clawed, usually narrow, entire or 2-fid or 3-lobed with a very short saccate or 0 spur. Column somewhat clavate upwards and cupular at the top, anther hinged on the back of the column and base resting in the hollow at the top, 2-celled, rostellum short, pollinia 2 or 4, pollen granular; stigma single transversely oblong.

1. **P. flabelliformis,** *Lindl.*

A curious little orchid with the scape arising from the top of a subglobose white tuber about 1″ diam. followed by a cordate-based ovate-acuminate or orbicular leaf 4·5–5·5″ diam. with 18–20 stronger nerves and as many or more finer intermediate ones; petiole 6–11″ long. Flowers green ·7″ long, spreading and drooping. Sepals ·6″ erect connivent lanceolate-linear acute, petals ·5″ similar, but with faintly brown nerves. Lip very narrow ·5″ straight, neither saccate nor spurred, sometimes slightly gibbous, side-lobes embracing the column white, brown-veined midlobe white flat projecting ·15″ beyond the side-lobes, ovate but not constricted at base, palate hairy with 3 green veins. Column ·3″. Ovary very short, ·2″, winged.

Ranchi, Ichadagh, 2500 ft.! Palamau, Neterhat, 3000 ft.! Rajmahal Hills *Kurz*! Fl. May–June. Leaf not fully developed until September.

The leaves show two forms: a very orbicular one with a somewhat trumpet-shaped base decurrent on the petiole and a more ovate-acuminate one with the base less decurrent. These may be different species or varieties, the orbicular-leaved one being the true *flabelliformis*, but the flowers described above *belong to the narrower-leaved form* without doubt as the flowering plant was grown on by me in a pot until its leaf developed.

Scape with 2–3 loose pale distant sheaths 1″ long on the peduncle.

6. VANILLA, *Swartz.*

Climbing almost shrubby orchids rooting from the nodes, branches with long internodes terete or angled. Leaves broad or reduced to scales, subsessile, coriaceous or fleshy. Flowers large in terminal and axillary short-peduncled racemes. Sepals and petals subequal spreading. Lip with the claw adnate to the column which is embraced by its broad concave limb. Column elongate; anther incumbent (pendulous), cells separate, pollen granular. Capsule long, fleshy, 1-celled, loculicidally 3-valved, without septa.

1. **V. planifolia,** *Andr.* Vanilla.

A suffruticose climber rooting in the ground but soon entirely dependent on its adventitious roots and becoming epiphytic. Leaves 4–9″ by 1·5–2·5″ broad elliptic-oblong or lanceolate-oblong cuspidate with very short sheathing petiole. Racemes 2–3″. Pedicels 1·5–2″. Flowers 1–2″ pale greenish or greenish-white with nerves of lip yellow, emitting a delicious fragrance at night. Sep. and pet. linear-lanceolate. Pod 6–10″ long and ·5″ diam., obtusely 3-gonous.

Cultivated in Ranchi! Fl. Feb.–April. Native of Mexico.

The well-known flavouring essence is derived from the fermented and dried pods and is due to *vanillin*, $C_8H_8O_3$, secreted at first by the hairlike papillæ lining the three interior angles of the pod and ultimately diffused through the oily seed covering. The flowers require artificial pollination (in Ranchi), and are then said to

yield the pods (at Palandu). They require harvesting as soon as they become pale yellowish-green.

Vanilla is also produced by *V. grandiflora* and *V. phacantha*, neither of which is believed to be grown in our area.

7. OBERONIA, *Lindl.*

Small tufted epiphytes without pseudobulbs, with equitant fleshy leaves articulate above the sheath and very minute flowers in dense subcylindric spikes or racemes. Sepals ovate or oblong, petals somewhat smaller, lip sessile, concave, entire or 2–4-lobed. Column very short, anther terminal, pollinia 4 waxy, cohering by a viscus.

A. Rhachis of inflorescence slender. Fls. shortly pedicelled :—
Petals broad, ovate, lip with small rounded or tooth-like side-lobes . . . . . 1. *Falconeri.*
Petals linear, lip with filiform side-lobes . . . . 2. *rufilabris.*
B. Rhachis thick fleshy. Flowers sessile :—
Lip entire . . . . . 3. *pachyrachis.*

1. O. Falconeri, *Hook. f.*

A curious little epiphyte with oblong-lanceolate or broadly ensiform distichous leaves ·5–2·5″ long and terminal spiciform racemes of inconspicuous greenish-yellow flowers ·07″ long, the perianth only ·03″ long. Hyaline bracts nearly as long as the flower, ovate-lanceolate or oblong, serrulate.

Frequent in Chota Nagpur. Singbhum ! Burkutta, plains of Behar on *Ficus* and *Bassia*, *J.D.H.* ! Hazaribagh, *Clarke* ! Ranchi, *Prain* ! Manbhum, *Campbell* ! Fl. Oct. Fr. Jan.

Racemes slender with short stout peduncle, 2–3″ long exceeding the leaves, erect or decurved. Pedicels very short. Petals ovate, lip oblong or subquadrate with small roundish or tooth-like lateral lobes, tip with 2 small incurved lobes separated by a broad sinus. Capsule ·12″ obovoid ribbed, shortly pedicelled.

2. O. rufilabris, *Lindl.*

This is frequent in the Jalpaiguri district whence I sent it to *Mr. Pantling*, and it probably occurs in Purneah. It is described as follows : " This lovely little gem . . . has fascicles of thickish equitant leaves and nodding terminal inflorescence of very small flowers in dense verticils, and with setaceous bracts surpassing the flowers in length. The small fls. are light camboge-yellow, ultimately turning light red. The lip and the margins of the column are deep brick red from the first, the lip has a thick hippocrepic callus at the base."

In evergreen strips of forest on branches overhanging streams ! Fl. Feb.

3. O. pachyrachis, *Reichb. f.*

A somewhat larger plant than the last two with leaves up to 4″. Easily recognized by the thick fleshy rhachis of the spike densely covered with the minute sessile imbricate flowers, and which appears to be terminal or lateral on a leaf, the latter being adnate to its peduncle.

This also probably occurs on trees overhanging streams in Purneah and perhaps Champaran, as it has been found in the districts each side of our northern area in such situations. Fl. Feb.–March.

8. MICROSTYLIS, *Nutt.*

Terrestrial (in our area) or sometimes epiphytic, stems often enlarged or tuberous below, leaves 1 or more not articulate on their sheath. Flowers small in terminal racemes. Sepals spreading or

recurved. Petals as long, slender. Lip posterior (*i. e.* uppermost), adnate to the base of column, concave or usually flat, sides often produced upwards beyond the column as auricles. Column very short, with short spreading arms, anther erect subterminal, pollinia 4.

A. Leaves several. Sides of the lip not produced upwards into auricles :—
Lip subquadrately ovate, apex 3-lobed . . . . 1. *congesta.*
Lip rounded reniform or fan-shaped, pectinate . . . 2. *versicolor.*
B. Leaves 2. Sides of lip produced upwards into auricles . 3. *Cardoni.*

1. M. congesta, *Reichb.*

A stout herb with leafy stem 2–6″ covered with large dry sheaths 1–3″ long below, base tuberous. Leaves 2–6, large elliptic, more rarely ovate or lanceolate, 2·5–7″ long, sessile or shortly petioled. Raceme dense 2–4″ or with peduncle up to 8″ or even 12″, pedicels ·12″. Flowers only ·2″ long, perianth ·1″ long, pale dirty reddish or yellow and greenish (purple in one figure and according to a note dull-red), lip subquadrately ovate concave with a fold under the column and a 3-lobed apex. Bracts reflexed linear-subacute ·1–·25″ (usually ·2″) long. Capsules ·3–·4″ long, dense, obtusely ridged between the ribs, ridges rough or papillose, sometimes again ridged between.

Naraiuhati, Sikkim Tarai (probably also Purneah)! Parasnath, *Clarke*! Sarguja (no doubt on plateau), *Cardon*! Fl. June–July. Fr. Oct.–Nov.

Leaves usually 4–7″ with the stronger nerves 6–7, base lanceolate or rounded and suddenly contracted on to the short petiole. Bracts on the scape very close and always strongly reflexed, linear-lanceolate acuminate.

2. M. versicolor, *Lindl.* Syn. M. Rheedii, *Wight.*

A slender or usually stout herb, always, however, ending in a slender scape, 6–18″ high, clothed with sheaths below the leaves. Leaves 3–4 aggregated at several inches above the base, elliptic or lowest ovate, 1–4″ long, very shortly acuminate, base rounded shortly petiolate. Scape and peduncle together from 3–4″ in weak to 9″ long in strong plants, with numerous reflexed lanceolate bracts ·1″ long. Flowers very small, sweet-scented, with perianth about ·1″ long only and ·2″ broad, the drooping linear petals exceeding the sub-ovate sepals, lip rounded reniform or fan-shaped, pectinate. Capsule ·3–·35″ long.

Grows among dead leaves. Ranchi, *Cardon*! Fl. July.

The Ranchi plant referred to *M. Rheedii* in the *Calcutta Herbarium* (and *Bengal Plants*) is an unusually small specimen only 3–5″ high with a raceme only 1–1·5″ long. The specimen was insufficient for critical examination. The leaf-nerves in the normal plant are about 7 (referring only to the stronger ones), and the flowers are described as red by *Rheede* and as greenish-yellow or purplish in the *F.B.I.*

3. M. Cardoni, *Prain.*

A small ground orchid about 6–8″ high with a single pair of sub-amplexicaul orbicular to elliptic-oblong obtuse leaves 1·7–2·5″ long and a not very dense raceme of small greenish flowers ·2–·25″. Sepals ell.-oblong much broader than the 2 linear petals. Lip with the central lobe erect and the two basal lobes divaricate from it and almost in the same plane, one on either side of the column, central lobe deeply emarginate, its apices rounded.

Sent from Chota Nagpur to the Calcutta Gardens by the *Rev. L. Cardon*, precise locality not recorded, but probably from Jaspur or Sarguja on our borders. Fl. July.

Tuber about ·5–·6″. L. 5–6 nerved. Bracts lanceolate, ·15″, reflexed.

9. LIPARIS, *L.*

Terrestrial (in our area) or epiphytic, often with pseudobulbous base. Leaves 1 or more, sometimes jointed on the sheath or pseudobulb. Flowers small in terminal racemes. Sepals spreading, recurved or revolute, margins often revolute. Petals as long, very slender. Lip anterior, adnate to the base of the column, usually broad, deflexed from a very short base or recurved. Column long, incurved, margined or winged towards the tip; anther terminal, pollinia 4.

Bracts ·08–·1″, sepals ·3–·4″. Peduncle many-angled . . 1. *bituberculata.*
Bracts ·17–·2″, sepals ·2–·25″. Peduncle 3-angled . . 2. *nervosa.*

1. **L. bituberculata,** *Lindl.*

A stout erect herb from a sub-tuberous rootstock, often tufted. Whole plant 12–20″ with raceme, stems 2–5″ to top leaf insertion, one or more loose sheaths at the base and lower leaves sometimes reduced to sheaths. Leaves 2–5, upper subopposite, broadly elliptic or ell.-ovate to lanceolate (elliptic-lanceolate, *F.B.I.*), 4–6″ long, base suddenly contracted into a short petiole, apex cuneate. Flowers a delicate pink, rather lax but many in the raceme with very small triangular spreading, erect and weakly reflexed bracts ·08–·1″ long. Sepals ·3–·4″ linear-oblong obtuse, lateral often revolute, lip ·25″ shorter than sepals decurved, cuneately obovate retuse, purple, 2-tubercled, margins entire.

In rocky streams, mountains of Chota Nagpur, Neterhat, 3000 ft.! Sarguja, *Cardon*! Fl. Aug. Fr. Oct.–Nov.

Leaves sometimes with wavy base which causes it to appear oblique in dried specimens, strong nerves 5–7, lateral arcuate to the tip. Peduncle grooved and angled. Pedicels ·25–·3″. Capsule ·7–1″. When gone out of flower it is easily distinguished from *Microstylis congesta*, which it then resembles, by the more distant fewer, shorter, less markedly reflexed bracts.

2. **L. nervosa,** *Lindl.* Syn. L. odorata, *Lindl.*; L. paradoxa, *Reichb. f.*

A more slender plant than the last 6–15″ high with much narrower usually oblong narrowly elliptic or oblong-lanceolate to linear-lanceolate leaves 3–6″ with shorter ones below, base tapering, sessile. Spikes 3–6″, rhachis angled, bracts long subulate or linear and very slender ·2–·3″, not reflexed (but see below). Perianth ·2–·25″ long.

Marshy places. Sarguja, *Cardon*! Fl. Aug.

The following description of a plant said to be *L. paradoxa* which was taken from a living specimen flowered at Kew does not appear to agree in the bracts: "Spike 3–6″. Bracts small triangular, deflexed. Sepals lemon yellow, nearly equal, margin reflexed, tip membranous. Petals oblong, shorter, inrolled, striped yellow and purple. Lip adnate to base of column purple, recurved, base minutely cared and with 2 conical glands, tip broad flat notched, upper half of column winged." Capsule ·4–·5″ rounded between the ribs which are decurrent on the ·1″ long pedicel.

10. PHOLIDOTA, *Lindl.*

Stems formed of superposed elongate pseudobulbs or with 1–2-leaved pseudobulbs sessile on a rhizome. Flowers small subglobose in the axils of distichous bracts in often flexuous close racemes. Sepals concave. Petals flat. Lip sessile on the base of the column, erect, saccate, subentire or 3–4-lobed. Column very short, hooded or winged. Anther-cells subglobose, rarely elongate, pollinia 4, subglobose, free or cohering in pairs by a viscus.

1. **P. imbricata,** *Lindl.*

A curious little epiphyte with numerous uninodal pseudobulbs seated on a creeping rhizome, 1-leaved only. Racemes drooping terminal, 4–12″, on a peduncle nearly as long, closely covered with imbricating distichous broadly orbicular-deltoid bracts each bearing a subglobose whitish or pale yellowish flower ·3″ diam.

On trees and rocks in the forests, Singbhum! Ranchi, at Neterhat, 3000 ft.! Fl. August.

Leaf 4–12″, elliptic-lanceolate, rather plicate and somewhat cuspidate, almost fleshy, 3-nerved, petioled. Apex of peduncle with several empty sheathing bracts, floral bracts ·3″ broad. Sepals ·2–·25″ long, dorsal orbicular 3-nerved, lateral cymbiform with winged keel, connate at the base. Petals linear-oblong falcate 1-nerved, lip 4-lobed, 2 large rounded side-lobes and 2 smaller quadrate terminal lobes. Pollinia deeply cleft, waxy. Capsule ·75″, ellipsoid on a thickened rhachis. The slender flower rhachis often persists after the fruits have fallen and till the next year.

11. THUNIA, *Reichb.*

Terrestrial or epiphytic, stems slender or internodes equally thickened, not pseudobulbous, leafy with foliaceous sheaths below, terminating in the inflorescence. Leaves distichous, lanceolate. Flowers in terminal racemes with large scarious bracts. Sepals erecto-patent, subequal, lanceolate. Petals similar. Lip adnate to base of column, shortly spurred, side-lobes short embracing the column, mid-lobe fringed. Anther narrow, pendulous, incomplete, 4-celled, pollinia 8, waxy, attached in fours to a granular membrane.

1. **T. venosa,** *Rolfe.* Syn. Phajus albus, *F.B.I.* (in part), and P. albus, *Beng. Pl.*

Epiphytic with elongate tufted stems 6–18″ long clothed with linear-ensiform leaves 6–9″ long acuminate above the middle, and with usually shorter lanceolate ones passing into sheaths at the base of the stems, lateral stronger nerves each side of mid-rib 2–3 rarely only one and numerous finer parallel nerves between them. Raceme drooping short 3–5″ including the very short peduncle, few-fld. with lanceolate sub-persistent bracts of which lower are 1·5–1·7″ long. Flowers white, 1·5″ long, lip 1·2″ with crisped side-lobes, spur ·15″. Sep. and pet. spreading oblong-lanceolate acuminate. Lip 1·2″ with involute crisped side-lobes, apex spreading waved and ciliate, palate with 5 longitudinal lines of soft erect purple fibrillæ and with radiating lilac-purple lines on to the side-lobes.

Sarguja, *Cardon*! Fl. July.

Thunia alba, Reichb. f., with which this was confused until the differences were

pointed out by *Rolfe*, has a somewhat elongate raceme, more and much larger flowers, a yellow disc to the lip and a few lilac radiating veins on the side-lobes. It has not been found in our area.

12. PHAJUS, *Lour.*

Stout terrestrial orchids with large plaited leaves, usually pesudobulbous with the inflorescence lateral on the pseudobulb or axillary or terminal. Flowers large, racemose. Sepals and petals subequal. Lip adnate to the base of the column and embracing it, erect with gibbous or spurred base. Column long stout without a foot. Anther incompletely 4-celled, pollinia 8, attached by fours to a granular viscus.

Leaves 1–2 ft. Scapes 2–4 ft. Fls. 4–5″ diam. . . . . 1. *Wallichii.*
Leaves 1 ft. Scapes 6–9″. Fls. 3″ diam. . . . . 2. *nanus.*

1. P. Wallichii, *Lindl.*

A handsome terrestrial orchid with large ovoid pseudobulbs sheathed by the plicate leaf bases. Leaves very large 1–2 ft. long by 3–6″ broad, elliptic-lanceolate acuminate plicate, long-petioled. Flowers in tall erect racemes from the side of the pseudobulbs 4–5″ diam. Sepals and petals spreading, pure white or sometimes coloured rosy-yellow or brown, especially inside, lanceolate. Lip with a tubular pink or red portion yellow at the base and a variously coloured truncate crisped midlobe, usually red. Spur ·25–·75″ long. Capsule 2–2·5″.

In its native state usually found in swampy ground near streams. Often cultivated. I cannot recall having seen it wild in our area, though it is so close to it in the Tarai and Duars. Fl. April–July. Fr. Sept.–Oct.

2. P. nanus, *Hook. f.*

This was first found by *Gamble* in the Buxa Duars, and was afterwards collected by me in the Jalpaiguri district much further west in grass lands. It may possibly therefore be found in similar grass lands in Purneah. Fl. Feb.

Pseudobulbs 0 according to *Hooker*, and I have no note of any. Leaves up to 1 ft. including the petiole into which the blade tapers, about 1–1·5″ broad. Scapes shorter than the leaves and axillary, 8″–1 ft., peduncle with narrow convolute or cymbiform bracts ·7–1″ long. Flowers few at the top of the scape. Sepals and petals spreading 1·5–1·7″ long lanceolate. Lip 1″ tubular with rounded spreading apex slightly crisped, spur ·1–·15″ (0, *J.D.H.*).

13. ACANTHEPHIPPIUM, *Blume.*

Terrestrial, bulbous with several broad plaited petioled leaves. Flowers few large fleshy in very short lateral racemes, pedicels thickened after flowering. Sepals broad, cohering into a ventricose tube, lateral adnate to the foot of the column and forming a very large saccate mentum. Petals erect narrow, included. Lip very small, stipitate on the foot of the column, inflexed, with broad erect lateral lobes and entire recurved midlobe, throat with a ridge or lamellæ. Column short, stout, with very long inflexed foot. Anther 2-celled, pollinia 8, erect, cohering by a granular mass.

1. A. striatum, *Lindl.*

A stout orchid with elongate-obpyriform pseudobulbs 3–4″ long and 1·5″ diam., a scarious-sheathed stem 4–8″ high and 2–3 large

elliptic leaves 6–10″ long. Scape cœtaneous, from base of the leafy stem and lateral on the pseudobulbous base. Flowers 1·25″ long and about ·65″ wide, pale pink with bold red lines, mentum and lip tinged with yellow.

Chota Nagpur (without precise locality), *Wood*! Fl. May–July.

Leaves with 4–5 very strong nerves and less strong intermediate, petiole short. Raceme sub-capitate on a stout peduncle 3–4″ with long imbricate sheaths often tipped with red. Bracts large cymbiform. Sepals broadly oblong, cohering, mentum conical. Petals concealed by the sepals, dimidiate-oblong. Lip concealed, oblong, with large lateral entire incurved lobes and a small triangular terminal lobe with undulate edges and a thickened ridge down the middle.

12. PACHYSTOMA, *Blume.*

Terrestrial orchids with a nodose rhizome or pseudobulb. Leaves 1–2 narrow plaited appearing after flowering. Flowers mod.-sized or rather small, pendulous on racemes, the bases of which are sheathed with bracts; floral bracts large scarious. Sepals subequal, lateral adnate to the base of the column. Lip sessile on the base of the column, erect, side-lobes oblong, midlobe small, centre usually ridged with 3–5 deeply crested or fimbriate ridges. Column slender, clavate above, produced into a foot below, anther 4-celled, deciduous, pollinia 8, pyriform, connected by viscus at their base.

1. P. senile, *Reichb.*

A graceful ground orchid with very long scapes and no leaves at the time of flowering, 12–18″ high. Flowers medium-sized, drooping, a delicate pink colour (in my specimens) or white or greenish (*F.B.I.*). Sepals white or pink ·3–·4″ acute or acuminate 5-nerved, petals slightly longer, narrowly spathulate, acuminate, 3-nerved, forming a very short sac at base, lip short from oblong "to nearly orbicular" (*F.B.I.*), with very short claw, side-lobes oblong obtuse or subacute, midlobe oblong or obovate, retuse or pointed, throat with 5 emerald green or yellow crested lamellæ from the base to the midlobe. Top of column with 2 incurved horns.

Frequent in grassy places in the northern tract, especially towards the Sikkim Tarai! Bettiah, *Hieronymus*! Fl. Feb.–May.

Bulbous. Leaf appearing after flowering, long narrow and plicate. Base of scape with strongly-nerved premorse or erose dry sheaths, bracts long linear. Flowers with ovary about ·7–·8″ long, glandular-puberulous.

15. GEODORUM, *Jack.*

Ground orchids with a tuberous rootstock and plicate leaves. Scape from the rootstock, stout erect sheathed, shorter than the leaves; flowers crowded in decurved racemes with narrow membranous bracts. Petals broader than sepals, conniving or spreading. Lip sessile on the base or short foot of the column, cymbiform, membranous, with involute margins, palate with or without ridges ending in calli, and with a forked basal callus. Column short, stout, anther 2-celled, appendaged after dehiscence by the persistent detached faces of the cells; pollinia 2, broad foveolate sessile or subsessile on a broad strap or gland.

1. G. dilatatum, *Br.*

A ground orchid with the scape 5–9″ high only flowering with the young leaves, which are lanceolate 15–18″ long and without petioles. Flowers 1·25″ diam. in a decurved raceme only half the height of the whole plant. Sepals white or greenish oblong acute 3–5-nerved. Petals rather broader, white. Lip spoon-shaped slightly recurved at the tip, white and pink-veined and flushed, palate yellow, quite smooth (in our plant), or with granulate nerves ending in irregular small tubercles.

Singbhum, in Sal forest! Tundi Hills, Manbhum, *Campbell*! Palamau! Hazaribagh, on Parasnath, *Thomson*! Fl. June–July. The Parasnath specimen Sept.

Rootstock a chain of ovoid tubers. L. only 6–8″ at time of flowering in the Manbhum specimen, narrowly elliptic.

16. EULOPHIA, *Br.*

Terrestrial herbs with tubers or pseudobulbous rhizomes and plicate leaves often appearing after the flowers. Flowers mod.-sized or large in lateral racemes, rarely panicled. Sepals and petals free, spreading. Lip saccate or shortly spurred at the base or forming a mentum with the foot of the column, lateral lobes erect, embracing the column, rarely 0, throat crested, softly spinous or lamellate. Column short or long with or without a foot and with oblique entire top* and terminal 2-celled anther. Pollinia 2 or 4, sessile or attached by a short strap to a discoid gland of the rostellum.

A. Column produced into a foot. Flowers large :—
Flowers golden yellow, very large, 3″ diam. . . . . 1. *flava.*
Flowers green or purple, about 2″ diam. . . . . 2. *nuda.*
B. Column not produced into a foot. Fls. mod.-sized :—
Sepals linear-lanceolate . . . . . 3. *campestris.*
Sepals oblong-ovate . . . . . 4. *explanata.*

1. E. flava, *Hook. f.*

A striking ground-orchid with scapes attaining over 3·5″ ft. bearing a raceme of a dozen to twenty golden-yellow flowers about 3″ diam. with spreading very acute sepals 1·4″ long. Petals narrowly elliptic-obovate obtuse 1·2″. Lip 1·3″ erect from foot of column, very saccate, 3-lobed, side-lobes erect rounded or truncate, mid-lobe orbicular or shovel-shaped concave, projecting about ·3″ beyond the side-lobes, throat with 3 lamellæ, sac purple-spotted within. Column stout, ·5″, with a short foot. Ovary narrow twisted, 1·5″ long, to 1·75″ long with the very short pedicel.

Marshy ground and white clay schist in the Singbhum forests! Ranchi and Palamau, elev. 3000 ft.! Fl. May–June.

Rhizome tuberous horizontal very large of about three flattened joints each 12–18″ long. Leaves lanceolate about 2 ft. produced after the flowers. Bracts ·5–·75″ linear-lanceolate acuminate. Lateral sepals rhomboid with obtuse base. " Anther with a 2-fid top and long anterior process," *J.D.H.*

* Top 2-fid in *E. flava* according to *F.B.I.*

2. **E. nuda,** *Lindl.*

A ground orchid about 12–20″ high, the scape arising from the base of the ultimate joint of a chain of wrinkled somewhat flattened tubers, one of which is formed annually. Flowers white or red, greenish or crimson, sub-globose, about 1·25–1·5″ from spur to tip of dorsal sepal. Sepals ·8–1″, linear-oblong or oblong, crimson green or yellowish, ·2″ wide, obtuse, lateral somewhat incurved erect, base forming a mentum with the forked foot of the column. Petals erect, ·7–·8″ by ·3″ wide in middle hooded over the column, somewhat oblique, obtuse, many-nerved. Lip oblong, not constricted, with erect short rounded side-lobes, midlobe nearly ·5″ spreading with wavy crenulate ridges at the sides, yellowish with pink veins or red-purple or pure white; spur ·15–·25″ long.

Frequent in Sal forests, rarer in grass-lands. Singbhum ! Ranchi ! Palamau ! Mayurbhanj, *Hooper* (? see below) ! Fl. May–June; leaves appear after flowering in June.

Annual tuber about 2″ long. Leaves plicate 10–15″ usually appearing after the flowers but in *Hooper's* specimen *with* the flowers, and in this also the raceme is close instead of lax as is usually the case. Bracts subulate acuminate, ·5″. Ovary with very short pedicel 1″ or lower longer. The floor or throat of the lip is nerved, not crenulate nor tubercled, the crenulations only occurring on each side, or in some cases 2 calli in the throat and nerves tubercled. Pollinia 2 large waxy sessile on a very broad appendage (caudicle).

3. **E. campestris,** *Wall.*

A slender orchid with flowering stem 8–12″ high, lateral from the last of a chain of erect ovoid tubers which are connected at their base. Flowers mod.-sized in lax racemes, sometimes secund or nodding on slender pedicels. Sepals ·4–·5″ linear-oblanceolate or linear-oblong, greenish outside, brownish inside, 5-nerved. Petals elliptic or broadly oblong obtuse, as or nearly as long as the sepals, ·2–·22″ broad, broader (*F.B.I.* says narrower !) than the sepals, greenish or yellowish with red or brown clouds, about 5-nerved. Lip ·35–·45″ long oblong, side-lobes erect or upcurved adnate to column, short, beautifully veined with red, midlobe slightly expanded and retuse at the end, yellow, palate with 2 crenulate lamellæ or ridges starting from the base of the column and tapering off to the end of the midlobe, the expanded part of which then has a crest of 5 fleshy papillose ridges. Spur hardly any and obtuse (in my notes and specimens; acute *F.B.I.*). Foot of column 0 or scarcely any. Pollinia 2, notched and perforated near the base, strap short and broad.

Not uncommon in open forest and burnt savannahs. Singbhum ! Ranchi ! Palamau, at Neterhat, 3000 ft. ! Fl. April–May.

4. **E. explanata,** *Lindl.*

A shorter stouter plant than *E. campestris* with scape 4–8″ lateral but from near the apex of an irregularly ovoid tuber or pseudobulb 1·5″ long from one of the lowest sheaths of the leafy stem, the leaves of which are very young (they just show at the surface in my specimen) at flowering time. Lowest sheaths of scape convolute much as in *E. campestris,* floral bracts ·3″ shorter than the ·5–·7″ long pedicel and ovary. Flowers yellow and purplish ·4″ long only. Sepals

oblong-ovate subacute or very obtuse. Petals broader elliptic 5–7-nerved obtuse. Lip sessile, base adnate to the lateral sepals, saccate with spreading nerves, subpanduriform upwards with 2 thick crenate lamellæ on the palate, and midrib greatly thickened and tubercled towards the truncate emarginate tip. Column very short.

Bettiah, *Hieronymus*! Kalahandi plateau, *Cooper*! Fl. April–May, after the grass fires. Leaves developed in August.

The Kalahandi specimen was identified as *E. explanata* at the Calcutta Herbarium but it is a very poor one. The young leafy shoots and the scape are surrounded by one or two short broad common sheaths ·5–1″ long as described for *E. explanata*, but most of the description of the flowers is taken from the *F.B.I.*, not from the specimen which has only one flower left on it. Fully developed leaves are large, broadly elliptic, 9–12″ by 4″, or lower only 5 by 3″, petioled, very shortly acuminate.

17. DENDROBIUM, *Swartz.*

Epiphytes with pseudobulbs or thickened or elongated stems. Leaves never plicate. Flowers often large and handsome, in 1–many-fld. racemes. Sepals subequal, lateral obliquely adnate to the foot of the column, and forming with it a sac or mentum. Lip contracted at the base, rarely clawed, adnate to and incumbent on the foot of the column, its side-lobes, if any, embracing the column or spreading, its terminal lobe variously formed, palate often lamellate. Column short, angled or 2-toothed at the top, anther opercular, at first erect (in the same axis as the column), ultimately opercular and versatile attached by the middle of the back, 2-celled, pollinia 4 free, ovoid or oblong, compressed, closely collateral in pairs in each cell.

I. Inflorescence apparently terminal (from the base of a terminal arrested internode) or also lateral :—
  A. Pseudobulbs short ovoid tufted. L. 2–3 linear. Fls. small, white or purplish in short dense racemes . 1. *pygmæum.*
  B. Stems elongate :—
    Stems copiously branched. Racemes very short, all terminal. Fls. few, small . . . . . 2. *herbaceum.*
    Stems thick, leafy. Racemes mostly lateral. Fls. very large, white . . . . . 3. *formosum.*

II. Inflorescence distinctly lateral :—
  A. Mentum urceolate. Fls. few crowded in short racemes on a sheathed peduncle, small, dingy yellow . . 4. *bicameratum;*
  B. Mentum conic. Fls. 1–3 in short racemes from the leafless stems :—
    1. Petals lanceolate, as narrow as the sepals. Fls. 1″, yellowish . . . . . 5. *macrostachyum.*
    2. Petals broad. Flowers never yellow (exc. lip) :—
      a. Fls. very large, 3–3·5″ diam., magenta . . 6. *regium.*
      b. Fls. 1·5–2·5″ diam., pink, purple or white. L. linear-lanceolate :—
        i. Stems slender, pendulous :—
          Sep. lanceolate acute. Lip with 1 or 2 broad purple blotches . . . . . 7. *transparens.*
          Sep. oblong-lanc. obtuse. Lip purple edged with white, base yellow . . . . *amœnum* (p. 1174).
        ii. Stems stout erect. Sep. oblong obtuse. Lip yellow . . . . . 8. *crepidatum.*
    3. Mentum short stout. Fls. large in 6–15-fld. racemes, mostly from the leafing stems :—
      Lip not calceolar. Fls. golden yellow . . . 9. *fimbriatum.*
      Lip calceolar. Fls. yellow, purplish or white . . 10. *moschatum.*

1. **D. pygmæum,** *Lindl.*

A small densely tufted leafy epiphyte with oblong or somewhat tapering greenish pseudobulbs 1″ long, linear-oblong or linear leaves 2–3″ and numerous short dense-flowered racemes of greenish or white flowers from the ends of the pseudobulbs. Racemes ·5–1″. Flowers about ·3″ on longest diameter, mentum about half as long as the lanceolate sepals, lip narrow curved with decurrent oblong green side-lobes marked with oblique red lines, mid-lobe very short in the sinus formed by the short free tips of the side-lobes, ovate crenate white with red markings.

Jaspur, *Cardon* ! Fl. Nov.

The plant was identified by *Col. Gage* at the H.B.C. The description is from a drawing made from the fresh plant. L. 2–3, caducous Scapes many, terminal and lateral. Bracts exceeding the ovary, nearly ·25″. Sepals ·3″ white or purplish, lateral decurved. Petals oblanceolate, lip obovate, midlobe triangular crisped, disk with a crenate fleshy ridge," *F.B.I.*

2. **D. herbaceum,** *Lindl.*

A much-branched epiphyte with very slender fleshy pendulous stems, linear or linear-lanceolate long-acuminate leaves 2–4″ long, tapering at the base, and very small yellow flowers ·2–·3″ long on slender pedicels in very short, few-fld. racemes near the tips of the leafless branches.

Parasnath, *T. Thoms.* ! *Cardon* ! Fl. July–Nov.

Lower parts of stem naked, upper with short sheaths. Leaves caducous, none at the time of flowering, nerves 8–10. Racemes only ·1–·5″ long with minute scarious bracts ·05″ long. Pedicels slender, ·4–·6″. Sepals linear up to ·24–·3″, sometimes only ·15″, 3-nerved, petals similar; lip very small narrow, side lobes very narrow, midlobe shorter ovate rugose.

3. **D. formosum,** *Roxb.*

A very beautiful orchid, without pseudobulbs but with several fleshy cylindrical somewhat furrowed stems 10–18″ long clothed with short black hairs when young. Leaves bifarious, subamplexicaul, ovate-lanceolate or oblong, 3–4″ long. Flowers very large, 3–4″ across, pure white except for the yellow palate, in terminal (or lateral, *F.B.I.*) few-fld. racemes.

Prain records this from Chota Nagpur in *Beng. Pl.*, stating in a note in the *Cal. Herb.*: "I have seen this from Sirguja in the collection of Sir C. C. Stevens." It is frequent in the Jalpaiguri district ! and may occur in Purneah. I have also seen an orchid very like it but not in flower at Neterhat. It is frequent in cultivation. Fl. April–May.

Sepals lanceolate or oblong-lanceolate acuminate, mentum very large conical petals broad, cuspidate, lip broadly obovate with small rounded side-lobes and dilated retuse midlobe, palate yellow with 2 tubercled ridges.

4. **D. bicameratum,** *Lindl.*

Stems clustered sub-clavate 3–18″ long and attaining ·35–·5″ diam. Leaves ell.-oblong to lanceolate, acute, obliquely minutely 2-fid at tip, 1·5–3″ long. Flowers ·4″ across, yellow, greenish-yellow or greenish-white with rows of crimson spots, densely clustered on a short rhachis in a lateral or sub-terminal capitate raceme.

Parasnath, *fide F.B.I.* Also Mahendragiri (*Gamble* !) Will probably be found therefore on Meghasani. Fl. Aug.–Sept.

Bract sheathing the shortly stalked ovary. Dorsal sepal broadly ovate-oblong,

lateral triangular, concave and subacute. Petals broadly elliptic, obtuse. Lip small, fleshy, very concave with broad very short truncate yellow central lobe and crimson triangular erect acute side-lobes, palate fleshy. Column very short with 2 large oblong nectaries and crimson border round the stigma.

5. **D. macrostachyum,** *Lindl.*

An epiphyte with rather slender terete pendulous stems 1–2 ft. long, and distichous coriaceous linear-lanceolate or lanceolate 10–15-nerved leaves, 2–3″ long contracted at the broad sheaths. Flowers paired or 3 together on very short common peduncles along the leafless stems forming a spurious raceme, short scarious bracts ·05″ long. Sepals and petals ·7–1″ long lanceolate acuminate recurved greenish-yellow tipped with pink, lip with convolute base and ovate mid-lobe veined with purple.

Manbhum (Sillee), *Wood*! Jashpur, *Cardon*! Fl. July–Aug.

Young stems with many very truncate sheaths ·3–·5″ long. Peduncles ·1–·25″, pedicels ·5–·6″. Flowers fragrant, mentum ·2″ long, lip sometimes (always ?) softly pubescent (silky to touch, *White*). Capsule 1–1·2″ oblanceolar with a thick rounded beak (remains of mentum and column).

6. **D. regium,** *Prain.*

A very handsome orchid with slightly compressed sub-fusiform stems 9–18″ long and ·4–·5″ thick and internodes 1–1·3″ long. Leaves linear-oblong or oblong-lanceolate 3–15″, narrowed to the obliquely notched tip. Flowers 3–3·5″ diam., magenta, in short 2–3-fld. racemes from the leafless stems. Sepals linear-oblong obtuse with red-purple veins. Petals elliptic or obovate, magenta or rose-purple like the sepals with red-purple veins and transverse markings. Lip trumpet-shaped glabrous with a rather narrow mouth, magenta with a pale yellow or cream-coloured tube. Capsule 2″ with rounded ridges.

Epiphytic on rocks. Sent from Bassia, Sarguja, by the *Rev. Father Cardon*.

7. **D. transparens,** *Wall.*

A very handsome epiphyte with pendulous leafless (at time of flowering) terete jointed stems with rose and white flowers 1·5″ diam. in pairs at the nodes. Leaves appear at the side of the flowering stems, linear-lanceolate 3–4″.

Sarguja, *Cardon*! is again the only record from our area, though it is also abundant in the Jalpaiguri district on the east of the province on Sissu trees, and may be expected in the intermediate districts either on the hills or in Purneah. Fl. April–May.

Internodes 1–1·5″ long. Bracts described (*F.B.I.*) as very large (I have no note of them). Sepals rose or pink lanceolate acute, petals broader ovate, mentum conic, lip elliptic-oblong from a convolute base, pubescent, 1″, white purple-veined or with a broad purple single or double blotch.

Closely allied to this is **D. amœnum,** *Wall,* with 2–3 flowers on short peduncles from the leafless stems. Bracts small. Fls. 1·5–2·5″ diam. Sep. obtuse white or with violet tip, pet. similar or purple-tinged larger ovate, lip ovate purple bordered with white and base yellow, undulate, crenate, ciliolate, palate villous.

Occurs near our area and in grass greenhouses in cultivation! Fl. h.s.

8. **D. crepidatum,** *Lindl.*

Stems pendulous striate green and white, thin at the base, thickened upwards, 6–18″, covered when dry with the long thin scarious sheaths of fallen leaves. Leaves linear-lanceolate acuminate 2–4″ by ·4–·6″. Flowers ·5–1″ long, pink or white with a large yellow spot on the lip, 1–3 on very short bracteate peduncles from the slightly swollen nodes of the leafless stems. Sepals broadly oblong subequal subobtuse. Petals broadly ovate. Lip broadly obovate, pubescent, edges undulate, apex broad sometimes retuse, base narrowed to a short claw with a short transverse ridge in front of it and a small pit behind.

Chota Nagpur (without precise locality), *Cardon* ! Fl. March.

Pantling (from whom the description is mainly taken) says that the flowers are ·75–1″ diam. and that the smaller-fld. Sikkim plant is self-fertile. The *Rev. Cardon's* plant was 1·5″ diam. and pink with buff on the base of the lip. Mentum short obtuse. Column very short and broad. Ovaries stalked divergent, very slender, purple. Capsule clavate 1·75″ long tapering into a long pedicel and terminated by the thick remains of the column and mentum.

9. **D. fimbriatum,** *Hook.*

Stems tufted 2–4 ft. long, grooved, terete, base swollen. Racemes pendulous on usually leafless, sometimes leafy, stems. Flowers chrome yellow 2″ diam., sepals erose or entire oblong spreading flat, petals larger subequal, ·75–1″. Lip 1·5″ long orbicular fimbriate, red-veined within and (var. *oculata*) with a deep reniform purple blotch.

Frequent in cultivation in Ranchi ! and occurs wild in Jalpaiguri district ! Only sent from Sirguja by the *Rev. Cardon* from our area. Fl. h.s.

Leaves distichous, ovate-lanceolate or lanceolate acuminate, 3–6″ long (6–8″ in var. *oculata* and strongly nerved). Flowers 7–12 in the lax raceme. Bracts herbaceous minute. Mentum short. Lip equally deeply fringed, with truncate base, undivided but sides somewhat erect and base concave.

10. **D. moschatum,** *Wall.* Syn. D. calceolaria, *Carey* (1823); Epidendrum moschatum, *Ham.* (1800).

A tufted epiphyte with stout terete erect striate stems, 3–6 ft. long and ·5″ thick with distichous oblong or oblong-lanceolate or (a few) ovate-oblong coriaceous leaves 3·5–6″ long, and large flowers 1·5–2″ or sometimes 3″ diam. in laxly 8–16-fld. lateral racemes 4–12″ long. Racemes one or two from a node very near the apex of a leafless or leafy stem, base of peduncle stout and with many sheathing imbricating bracts, pedicels slender 1–2″ long. Colour very variable, usually golden-yellow in our area with 2 dark spots on the calceolar, pyriform or hemispheric lip, the margins of which are much incurved all round and slightly fimbriate.

Sarguja, *Cardon* ! Occasionally cultivated in our area ! Fl. May–July.

Stems leafy. L. with subamplexicaul base, obtuse or subacute, with about 9 stronger parallel nerves. Fl. rhachis deflexed often zigzag with floral bracts scarious narrowly oblong obtuse ·4–·6″ long. Flowers fragrant, odour often musky, 1–2″ long with a pronounced mentum, colour of flowers variously described or figured as white or gold or yellowish-pink, or sepals and petals ochraceous with reddish tips and orange or red veins and lip ochraceous with 2 large brownish spots inside the cup, or (in a Khasia form) blood red with spur dark yellow. Capsule 1″ obovoid with thickened truncate beak (remains of column, etc.).

18. ERIA, *Lindl.*

Epiphytes, usually with pseudobulbs, sometimes with leafy stems. Flowers never large nor brightly coloured, mostly spicate or racemose. Sepals free adnate to the foot of the column and with it forming a short or long and spur-like or saccate mentum. Lip sessile on the foot of the column, incumbent, rarely mobile, entire or 3-lobed with erect side-lobes. Column short. Anther imperfectly 4- or 8-celled, pollinia normally 8, pyriform or broadly obovoid, attached in fours by narrow bases to a viscus.

Flowers mod.-sized. Inflorescence woolly . . . . . 1. *flava.*
Flowers very small. Inflorescence glabrous . . . . . 2. *muscicola.*

1. E. flava, *Lindl.*

A moderate-sized epiphyte with a stout creeping branched rhizome, branches ending in pseudobulbs 2–3·5″ long with sheaths at their base. Leaves 3–5 on a pseudobulb lanceolate-linear 6–10″ long by ·7–1·2″ broad. Racemes lateral 5–10″ long clothed all over including the flowers with a dense wool. Flowers mod.-sized with sepals ·5–·7″ long, broadly lanceolate, yellow and 7(–9)-nerved inside. Petals yellow, narrow, 3–5-nerved, lip yellow with purple markings ·4–·5″ long with 2 short lateral lobes and broadly oblong longer mid-lobe, not woolly. Capsule linear, 1–1·3″ long.

Recorded from Chota Nagpur in *Bengal Plants*, but I find no specimens. My own specimens are from the Jalpaiguri district, and from its general distribution it probably occurs near our northern boundary, esp. Purneah. Fl. Feb.

2. E. muscicola, *Lindl.*

A very small orchid only 1–2″ high with depressed ovoid clustered pseudo-bulbs ·3–·5″ long and several small leaves ·5–·8″ long. Flowers few very small greenish in filiform racemes from between the leaves. Bracts ovate or lanceolate. Sepals lanceolate finely acuminate 1–3-nerved, lateral falcate. Petals narrowly lanceolate 1–3-nerved, lip narrowly lanceolate or slightly dilated in the middle.

I have seen no authentic specimen from our area either at Calcutta or Kew, but it is given in *Bengal Plants*. Fl. June–Aug.

L. oblanceolate or linear-oblanceolate ·5–1·5″ long. Flowers sometimes described as pure white, ·2–·25″ long.

19. BULBOPHYLLUM, *Thouars.*

Epiphytes with a creeping rhizome bearing pseudobulbs which are 1– very rarely 2-leaved. Flowers often small, solitary, capitate, umbelled spicate or racemose, from the base of the pseudobulb, rarely remote from it. Lateral sepals adnate to the foot of the column. Petals usually smaller than the dorsal sepal. Lip jointed on the foot of the column, mobile, usually very small and strongly recurved. Column very short, often 2-aristate at the top; anther 2-celled, pollinia 4.

1. B. triste, *Reichb.*

A curious little plant with globose-ovoid small pseudobulbs under 1″ and a very long slender scape 6–7″, bearing a small raceme of small

purple flowers ·25–·3″ long with pink petals and a disagreeable smell of bugs.

Sent by *Rev. Cardon* from Sarguja to the Botanic Gardens, Calcutta, where it flowered Feb.! Also fls. March–May. Leafless when in flower.

Leaves 2. Inflorescence dense, bracts minute acute. Dorsal sepal shortest triangular-ovate obtuse 3-nerved, lateral falcately oblong obtuse. Petals ovate-oblong 1-nerved. Lip stipitate broad convex obtuse. Spurs on column slender.

20. CIRRHOPETALUM, *Lindl.*

Habit of *Bulbophyllum* mostly with small 1-leaved pseudobulbs on a creeping rhizome. Flowers usually small, umbellate, rarely umbels reduced to 1–2 flowers. Median sepal free, lateral sepals much longer twisted on their long axis and with their outer margins more or less conniving. Petals much shorter, often fimbriate or appendaged. Lip linguiform, very small, stipitate. The rest as in *Bulbophyllum*.

1. C. ornatissimum, *Reichb.*

A remarkable and curious little plant with ovoid pseudobulbs bearing 1 (rarely 2) oblong leaf 3–4·5″ long and purple flowers, the umbels reduced to one or two flowers.

Jashpur, *Cardon*! Fl. Oct.

I have only seen the one specimen. It has 2 flowers, and the tips of the sepals are broken off in one and in the other are 2·3″ only, erect. In a drawing of *C. ornatissimum* at the H.B.C. the sepals are 3–4″ long (as described by *Prain* for our plant), but on this drawing *Rolfe* has remarked *C. Mannii* NOT *C. ornatissimum*. It is also much smaller than the *C. ornatissimum* from Sikkim which has sepals filiform up to 4·5″ (= C. *appendiculatum*, *Rolfe*?). The linear lip is ·3″ long. The *F.B.I.* describes *C. ornatissimum* as with lateral sepals 2–4″ linear-lanceolate with filiform tips 6-nerved much longer than the cymbiform acuminate 5-nerved dorsal, petals subulate-lanceolate falcate 3-nerved and dorsal tipped with a brush of slender red paleæ, lip strigose, columnar, arms large decurved.

21. LUISIA, *Gaud.*

Tufted epiphytes without pseudobulbs, with terete rigid sheathed stem and elongate terete obtuse leaves. Flowers small drooping on a short or very stout erect axillary rhachis, bracts persistent, very short thick and imbricating. Sepals subequal or the decurved dorsal smaller. Petals narrower often longer. Lip sessile on the base of the column, base flat, concave or saccate. Column very short, truncate; anther 2-celled, pollinia 2, sub-globose, seated on a replicate short strap. Capsule narrow erect.

Leaves 4–5″.	Flowers ·4″ long	1. *trichorhiza*.
Leaves 1–2″.	Flowers ·15″ long	2. *inconspicua*.

1. L. trichorhiza, *Blume.*

Stems rather stout with thick truncate sheaths. Leaves stout terete 4–6″ long. Flowers ·4″ long. Sepals and petals pale yellowish green with faint purple lines. Petals about as long as the lateral sepals. Lip rather longer than the sepals, dark purple with faint green lines, obovate-oblong flat grooved constricted between the broadly ovate or subcordate epichile and the quadrate hypochile. Column purple. Capsule ·6″ strongly ridged narrow with attenuate base.

Chota Nagpur, communicated by *Father Cardon* to the Cal. Bot. Gard., probably from Sarguja ! Fl. March–April.

2. **L. inconspicua,** *Hook. f.* Saccolabium ? inconspicuum, *Hook. f.* (*F.B.I.*).

Stems 6–8″ long, interlaced, flexuous, internodes ·5″ only. Leaves 2–3″ or (in our specimen) only 1–2″, nearly straight, terete, obtuse. Flowers ·15″ long, ·25″ diam., shortly pedicelled clustered. Sepals and petals pale yellowish green, subequal, broadly oblong acute, lip about as long, green, suffused with purple on the hypochile, epichile subreniform, notched at apex, flat. Column short, very stout, purple. Capsule ·25″ long, ribbed.

Manbhum, *Campbell* ! Fl. June–July. Fr. Sept. *Campbell's* original plant was sent in fruit (from Jonha) and it was flowered in the Calcutta Gardens. *Hooker's* description was from a drawing of the species from Lower Assam.

Stems rather stout (*Hooker*) or slender, entirely clothed with venose sheaths. Spikes 1–3-fld., very short, floral bracts membranous triangular acuminate. Sepals sometimes described as ovate-lanceolate, subacute, spreading, hypochile hemispherically saccate, epichile decurved, flat, sometimes minutely hispid and with 5–6 vertical lines.

22. RHYNCHOSTYLIS, *Blume.*

Epiphytes without pseudobulbs but with stout leafy stem. Leaves very thick linear 2-lobed at apex. Flowers mod.-sized in long dense drooping cylindric racemes. Sepals and broader petals spreading. Lip adnate to the base of the column, deeply saccate and pubescent at the mouth of the sac, without side-lobes, limb clawed, dilated. Column short stout footless, rostellum shortly beaked ; anther imperfectly 2-celled, pollinia 2, subglobose, 2-cleft with filiform caudicle attached to a small gland.

1. **R. retusa,** *Blume.*

Stem stout, closely covered with leaf-sheaths. Leaves 6–20″ by ·7–2″, curved, deeply channelled above, keeled beneath, premorse or retuse. Flowers white, blotched with pink or violet, ·5–·75″ diam. in drooping racemes 4–18″ long with broad bracts. Lateral sepals gibbously orbicular-ovate, obtuse or apiculate, dorsal oblong, lip with the sac cylindric and much longer than the limb.

Ranchi, *Cardon* ! Manbhum, *Ball* (specimen bad and scarcely determinable)! Fl. May–July.

Petals elliptic, obtuse. " Epichile of lip very variable in size, usually cuneiform, entire or emarginate at the tip," *F.B.I.* Capsule 1–1·5″, clavate.

23. DORITIS, *Lindl.*

Epiphytic orchids without pseudobulbs, with short stems and flat coriaceous leaves. Flowers mod.-sized in lax axillary or lateral racemes. Sepals and petals spreading, similar. Lip adnate to the long foot of the column and forming with it and its erect side-lobes a conical sac, palate with a forked plate or callus. Column narrowly winged. Anther 2-celled, pollinia 2, sulcate or 2-partite attached by a linear or spathulate caudicle to a gland.

1. **D. Wightii,** *Benth.*

Pendulous from branches with very short stout stems 1″ or less long. Leaves about 3, oblong slightly wider upwards subundulate at margins, obtuse, minutely obliquely notched, 6–8″ by 1·3–2″. Flowers inconspicuous pale ochreous yellow with purple markings on the lip and pink-mottled at base of tepals, on a pendulous lateral raceme shorter than the leaves.

Chota Nagpur (without precise locality), *Prain* in *Bengal Plants*, but I can find no specimens, not is it in *Wood's* list. Fl. July.

Median sepal oblong, lateral shorter and broader, falcate, obliquely truncate. Petals oblong blunt. Hypochile forming a conical sac with 2 erect very broad ridged fleshy truncate lobes, epichile obovate with a forked appendage.

24. SARCANTHUS, *Lindl.*

Characters of *Saccolabium*, but spur with a dorsal usually 2-lobed callus or an erect plate within, inserted under the column, and with the cavity more or less divided by a vertical septum.

1. **S. insectifer,** *Reichb. f.*

A small epiphyte with elongate creeping stem and 2-farious subimbricate amplexicaul oblong leaves ·5–1·5″ long, coriaceous, keeled, obtusely 2-lobed with sometimes a mucro in the sinus. Flowers small greenish in lateral short-peduncled few-fld. corymbs, ·6″ only from tip of lip to tip of posterior median sepal. Lateral sepals broadly oblong slightly falcate green with brown streak each side, ·2″, median rather narrower.

Frequent in Chota Nagpur. Singbhum! Hazaribagh, *J.D.H.*! Chota Nagpur (Ranchi?), *Wood*! Fl. June–July.

Pteals similar to the sepals but oblong-oblanceolate. Lip ·4″ fleshy, base pale saccate, scarcely spurred, with 2 very short erect, rounded side-lobes and a large cordate pink fleshy midlobe contracted at its base. The "sac" is longitudinally septate and papillose in the throat, which is closed (as in *Cleisostoma*) by a curved ligulate process from the base of the column which can be pushed aside by an insect. Column very short 2-horned, pollinia round waxy, very strongly attached by an elastic caudicle to a broad membranous gland which is viscous in front.

25. CLEISOSTOMA, *Blume.*

Characters of *Saccolabium*, from which it differs in having a dorsal scale or callus within the spur beneath the column and differs from *Sarcanthus* only in the spur not being septate.

Sir J. D. Hooker remarks that but for the multiplication of names it would be better to unite *Cleisostoma* and *Sarcanthus* with *Saccolabium*.

1. **C. micranthum,** *King & Pantl.* Syn. Saccolabium micranthum, *Lindl.*

A small epiphyte with stout compressed stems 3–8″ long covered with leaf-sheaths. Leaves narrowly oblong keeled obliquely truncate and slightly 2-fid, 2·5–3·5″ by ·5–·6″. Flowers very small, many in the lateral racemes, ·2″ diam., white with large pink spots, entirely pink or purple on the lip.

Sarguja, *Cardon*! Fl. July–Aug.

Leaf-base shortly sheathing. Racemes longer than the leaves with stout rhachis. Sep. broadly ovate, obtuse, spreading. Pet. smaller, oblong. Lip fleshy as long as sep., base with a wide blunt spur adpressed to the ovary, with a

large callus protruding so as to meet a smaller callus projecting from the posterior wall, lateral lobes of lip small, apical oblong convex with thin erose edges. Column with a large cheek-like protuberance each side of the rostellum. Anther depressed with a long beak. Capsule ·25–·3″ (ripe ?).

26. SACCOLABIUM, *Blume.*

Epiphytes without pseudobulbs, with leafy stems and flat, keeled or terete leaves. Flowers usually small in lateral spikes, racemes or panicles, sometimes subcorymbose. Sepals and petals spreading subsimilar free but adnate to the base of the column, lip sessile at the base of the column, usually consisting of a large saccate or cylindric spur, small lateral lobes and a small midlobe, sac or spur not septate within (as in *Sarcanthus*) and without a large scale or callus within under the column. Column short, broad, truncate, rarely beaked, without a foot; anther 1- or imperfectly 2-celled, pollinia 2, entire or 2-partite.

Our 2 species both belong to section *Acampe* with keeled thickly coriaceous leaves, flowers corymbose, lip a large hemispheric sac with truncate or short side-lobes and a short warted reniform or ovate adnate erose or fimbriate midlobe, very short column and globose pollinia with linear caudicles. *Acampe* is now generally maintained as a distinct genus.

Midlobe of lip suborbicular or broadly ovate, spur a rounded sac tubercled and pubescent at the base within . . . 1. *præmorsum.*
Midlobe of lip ovate, spur conical, pubescent within . . 2. *papillosum.*

1. S. præmorsum, *Hook. f.* Syn. Acampe Wightianii, *Lindl.*

A small epiphyte with leafy stem 5–6″ or up to 1 ft. Leaves 5–7″, narrow. Flowers yellow with transverse red markings, ·5–·7″ diam., papillose all over, on a short stout scape only 1–2″ long. Lip deeply lobed, very complicate, midlobe broadly ovate or suborbicular, spur a rounded sac tubercled and pubescent at the base within.

Hundrughagh, Ranchi, *Prain* ! Fl. r.s.
Internodes ·5–1″ long. Racemes with thick rhachis breaking laterally through the leaf-sheaths. Leaves linear, very firm, premorse, articulate just above their sheath, about 6″ long and 1″ broad. Bracts minute triangular, but their base shows an annular ring. Lip dotted pink. Capsule 2″ narrowly fusiform.

2. S. papillosum, *Lindl.* Syn. Acampe papillosa, *Lindl.*

Stem elongate 2–3 ft. branched, creeping along the tree branches, slender with obliquely notched leaves 3–4″ long. Flowers ·5–·7″ diam., capitate on a short scape only 1–2″ long which is closely scarred (nodal scars) to the base. Lip with ovate midlobe and short conical spur pubescent within.

Sarguja, *Cardon* ! Fl. July (Oct.–Jan., *Pantling*).
Stems (according to *Pantling*) erect rigid clustered ·35″ thick bearing many sub-horizontal coriaceous curved deeply channelled (as in last) leaves 3–4″ by ·6–·8″, apiculate at the unequal tip. Peduncle only about ·5″ bearing a sub-corymbose 4–8-fld. raceme. Flowers sometimes ·7″ across (*F.B.I.*), sepals and petals yellow with brown bars (*Lindley* shows red dots), oblong, petals narrower sub-spathulate, lip slightly longer, decurved, ovate-oblong, white with pale purple markings crenate and transversely rugulose and with a cylindric slightly tapering pale-yellow spur, hairy within, side-lobes 0. Capsule fusiform, ridged, 1·25″ long.

27. VANDA, *Br.*

Epiphytes without pseudobulbs, with leafy stem and very coriaceous or fleshy flat keeled or terete leaves and usually large (rather small in *parviflora*) showy flowers in simple racemes. Sepals and petals subequal, spreading or incurved, with narrowed base, lip large with large or small, rarely 0, side-lobes placed on the sides of the saccate or spurred base, midlobe fleshy, palate usually ridged or lamellate. Column short and stout with scarcely produced foot; anther 2-celled, rostellum obscure, pollinia 2, didymous, sub-globose or obovoid with broad flat geniculate caudicle and rather large gland.

Flowers ·6–·7″ diam. yellow with pink or bluish lip . . . 1. *parviflora.*
Flowers 1·5–2″ diam., colours not yellow, tessellated . . . 2. *tessellata.*

1. V. parviflora, *Lindl.*

A small epiphyte with short leafy stem 4–6″ and distichous fleshy leaves 3–4″ long keeled beneath, margins upturned and tips irregularly premorse. Flowers yellow ·6–·7″ diam. with pink lip (according to my field notes on several occasions, with fleshy blue ridges, *F.B.I.*), in 3–12-fld. erect racemes 2–4″ long with long white pedicels ·7″ long and very small scarious bracts at the base of each flower.

Singbhum! Manbhum, *Camp.*! Ranchi! Palamau, at Neterhat, elev. 3000 ft.! Sant. Parg. *Swindon*! Fl. April–May.

Sepals ·3″, oblanceolate, somewhat waved; petals slightly narrower, lip with a pronounced mentum and spur, side lobes erect decurrent on the mentum ·15″ long, minutely dotted with pink, midlobe ·2″ oblong with somewhat dilated rounded yellow tip, floor or palate thickened with 2 calli and dotted pink. Foot of column and spur together nearly ·2″, column short erect ·07″, anther with lateral hinged scale-like valves, cells finally confluent. Pollinia waxy deeply 2-fld.

2. V. tessellata, *Hook.* Syn. Vanda Roxburghii, *Br.*; Cymbidium tesselloides, *Roxb.*; Epidendron tessellatun, *Roxb.*; Ærides tesselatum, *Lindl.*

Stems 1–2 ft. with narrow complicate premorse leaves 6–8″ and handsome tessellated flowers 1·5–2″ diam. in long 6–10-fld. suberect racemes. Sepals and petals yellowish-green or blueish with brown nerves, subequal clawed obovate waved, lip half as long to nearly as long with small acute side-lobes and panduriform violet or crimson midlobe with dilated truncate 2-lobed tip, spur conical.

One of the commonest species in Behar and Chota Nagpur, especially on Mohwa trees, probably in all districts of Chota Nagpur! Mayurbhanj, *Hooper*! Fl. April–July.

Very variable in colouring but always recognizable from the tessellated sepals and petals, margins often white. Midlobe of lip with fleshy ridges and white margins and mesial lines.

28. ÆRIDES, *Lour.*

Epiphytes without pseudobulbs, with leafy stems and linear, coriaceous leaves. Flowers showy, usually many in dense or lax decurved racemes. Sepals broad, spreading, lateral adnate to the base or foot of the column. Petals broad, spreading. Lip spurred, side-lobes sometimes 0, midlobe larger than the side-lobes or smaller and incurved between them. Column short, foot long or short, rostellum short or long and bifid, anther 2-celled, beaked or not,

pollinia 2, globose, sulcate, caudicle strap-shaped long or short, gland large or small.

A. Side-lobes of lip very small, midlobe large :—
Spur short straight . . . . . 1. *multiflorum.*
Spur uncinately incurved . . . . . 2. *maculosum.*
B. Midlobe of lip incurved between the much larger side-lobes . 3. *odoratum.*

1. Æ. multiflorum, *Roxb.*

A rather stout orchid with stems 4–10″ long clothed with deeply channelled and keeled imbricate emarginate or 2-lobed leaves 6–8″ long and with copious long axillary racemes of pink or rose-purple flowers ·75–1·2″ diam. Sepals and petals subequal rounded oblong, lip twice as long, sides recurved, midlobe hastately ovate or triangular with rounded angles, spur one-fourth as long as the midlobe, pointing forwards under it, with an incurved fleshy 2-lobed callus on the base of the midlobe.

Manbhum, *Campbell* ! Sarguja, *Cardon* ! Santal Parganahs, *Chatterjee* ! Occurs also in the Sikkim Tarai and probably in Purneah. Fl. May–June.

Racemes 6–12″, rarely branched (*F.B.I.*), shortly peduncled. Flowers sometimes spotted with darker purple. Midlobe of lip (according to my field notes) large spreading ovate-rhomboid, clawed, the side-lobes being insignificant and appearing as wings to the foot of the column ; base of lip thick and with a retrorse callus pointing across the mouth of the rectangularly bent spur. Capsule ·5–2″ subclavate, ·6″ (ripe ?) long, sharply 3-keeled and with smaller ridges between, contracted into a stout pedicel ·25–·35″ long.

2. Æ. maculosum, *Lindl.*

Stems shorter than in *multiflorum*, leaves more flat and racemes more often branched, flowers larger but very variable in size, pale spotted with darker purple, midlobe of lip ovate, tip broad, bright rose, obtuse or retuse, margins undulate, spur longer and more slender than in *multiflorum*, uncinately incurved.

Said to occur in Chota Nagpur (*Beng. Pl.*), but I do not know on what grounds. I can find no specimens from our province.

The description is from the *F.B.I.* Capsules narrower and more elongate than in *Æ. multiflorum*.

3. Æ. odoratum, *Lour.*

Stem and roots stout, stems attain 12–18″ (in the Tarai, less in Chota Nagpur) with leaves 6–10″ by ·75–1·75″, thickly coriaceous, 2-lobed, lorate, keeled. Flowers ·75–·8″ diam. in dense racemes 9–12″ long, white with rose-purple at the tips of the perianth segments, lateral sepals larger than the dorsal and petals, lip with rose-coloured midlobe and upcurved mottled pink spur longer than the sepals, claw of lip long continuous with the produced foot of the column rose-coloured, side-lobes erect, white, embracing the small midlobe, which is oblong-lanceolate, entire or erose.

Jalpaiguri district and Sikkim Tarai and therefore probably Purneah ! Singbhum ! Fl. May. Often cultivated !

Lobes of leaf rounded. Peduncle stout and rhachis stout, bracts brown, persistent, pedicel with ovary 1″ long. Flowers sweet-scented about 1″ in length (excluding the ovary), sepals and petals broadly oblong-obovate and rounded, upturned tip of spur sometimes green (in a cultivated specimen), spur hollow with a 2-fid gland in the throat at base of mid-lobe. Anther obtuse (*F.B.I.*) or beaked (*according to my notes* !). Capsule 1–1·5″ oblong clavate with obtuse angles (*F.B.I.*) tapering into a pedicel ·4″ long.

DIVISION.—PTERIDOPHYTA.*

Order FILICALES. *Ferns.*†

FAM. 1. CYATHEACEÆ.

Mostly tree-ferns with a well-developed aërial trunk and very large leaves. Sori round dorsal or apical on the fertile nerves with a subspherical or converse very hairy receptacle. Sporangia numerous dense, sessile or stalked, obovate with a broad vertical or suboblique elastic complete annulus. Indusium inferior or absent (*Alsophila*).

1. ALSOPHILA, *R. Br.*

Sori dorsal, globose. Receptacle elevated, villous. Indusium 0. Frond pinnately decompound, veins never anastomosing, simple forked or pinnate.

1. A. glabra, *Hook.*

A tree-fern 10–20 ft. high. Petiole asperous and rhachis almost purple. Fronds 2-pinnate with pinnæ 1·5–2·5 ft. long, pinnules 3–6″ by 5–9″ wide, glabrous beneath, pinnatifid $\frac{1}{4}$–$\frac{1}{2}$-way down, veins simple or few 2-furcate.

Chota Nagpur, *Wood*! but no doubt from the old Commissioner's compound in Ranchi, where it was planted. There is no wild *Alsophila* in Chota Nagpur, though I have found both this and *Cyathea spinulosa* in the deep ravines of the Pachmari Hills (Central Provinces).

FAM. 2. POLYPODIACEÆ.

Perennial, very rarely annual, rarely tree-like ferns. Rhizome sometimes creeping over trees and rocks. Leaves with normal epidermis and many-layered lacunose mesophyll. Sori rarely marginal, though sometimes very close to margin, usually on the underside of the leaves, dorsal or terminal on the fertile veins, at times also spreading on to the parenchyma between the veins, naked, or covered by the more or less modified leaf margin or by a special variously attached and shaped indusium. Sporangia usually long-stalked, almost always with an incomplete vertical annulus which is interrupted on one side near the stalk, opening by a transverse fissure due to the elastic straightening of the annulus. Spores globosely-tetrahedral or bilateral.

In the following key I have shown some genera twice for convenience. There is much difference of opinion with regard to the position of these. Probably it would be better to restore the tribe *Grammitideæ*, in which *Gymnogramme*, *Hemionitis* and *Drymoglossum* would be placed, whereas *Diels* shows them in the position

* See Introduction. All the following families should logically have been placed in the following order previous to the Dicotyledons. The Dicotyledons were taken up first because they are of prior importance and in conformity with the usual practice in English works on systematic botany.

† The order of the venation in the ferns after primary rhachis, secondary rhachides, etc., in compound fronds is costa, costule, veins, veinlets. The costule being the midrib of a lobe is not always present and sometimes the general term "vein" is sufficiently explicit.

as numbered in the key. *Gymnopteris* he includes in the *Aspidieæ*, whereas *Beddome*, rightly I think, shows it as numbered below. As regards the position of several species of *Nephrodium*, included by several botanists under *Polypodium* merely on account of the absence of indusium, I have had no hesitation in placing them in *Nephrodium* as is done by *Diels* and *Beddome*, and I have not shown these twice.

I. Sori confined to the venation, not occupying the whole surface of whole or part of the frond (Genera 1–23) :—
  A. Indusium present, or margin of frond modified or recurved over the sori, or if indusium absent then fronds not articulating with the rhizome (Genera 1–19) :—
    1. Sori round. Indusium round or nephroid or half-orbicular, extrorse or peltate and opening on all sides, sometimes rudimentary or 0. (Genera 1–8) :—
      a. Sori dorsal or terminal on the veins, attached by a point, by the centre or a sinus. Leaf-margin unmodified. Stipes never articulate (*Aspidiæ*):—
        i. Indusium nephroid or rudimentary or 0. Venation pinnate, often herring-bone type:—
          Frond simply pinnate (in our species). One or more veins from the costule uniting with those from the adjacent costule . . 1. *Nephrodium.*
          Frond 1–more pinnate. All veins free . . 2. *Lastrea.*
        ii. Indusium peltate or, if 0, then venation reticulate :—
          † Frond compound, not or only slightly dimorphic :—
            Venation pinnate, free. Teeth of lobes spinulose . . . . . 3. *Polystichum.*
            Venation copiously anastomosing with free included veinlets . . . . . 4. *Aspidium.*
          †† Frond simple, dimorphic. Fertile much contracted. (Sori occasionally scattered over the back of a normal frond) . . 24. *Gymnopteris.*
      b. Sori mostly terminal on the veins. Indusium extrorse attached by a broad base or partially adnate to the leaf margin, which is often modified. Fronds 1–more pinnate, sometimes articulate to rhizome. Veins free (*Davallieæ*):—
        i. Sori not confluent. Indusium attached by a broad base :—
          Stipes inarticulate, pinnæ articulate. Frond simply pinnate, with cretaceous dots . 5. *Nephrolepis.*
          Stipes articulate, pinnæ inarticulate. Frond 3–4-pinnatifid, without cretaceous dots . 6. *Humata.*
        ii. Indusium adnate on three sides to the frond. Frond inarticulate :—
          Fronds 2-ranked on the creeping rhizome. Receptacle distinct . . . . 7. *Microlepia.*
          Fronds tufted. Sori marginal. Receptacle not evident . . . . . 8. *Odontosoria.*
    2. Sori oblong or linear, straight or curved. Indusium present or margin of frond simulating an indusium :—
      a. Sori lateral on the fertile veins. Indusium introrse or if double also extrorse. Veins, at least the barren ones, free (*Asplenieæ*) :—
        i. Sori attached to and parallel to the veins. Veins all free :—
          † Sori short, one only to a vein :—
            Indusium straight linear or oblong. Scales of stipes with thick-walled cells . . 9. *Asplenium.*
            Indusium usually curved or hooked and overlapping the vein. Scales of stipes with very thin walls . . . . 10. *Athyrium.*

†† Sori, at least one (usually the lowest) on each lobe paired, indusia opening in opposite directions . . . . . 11. *Diplazium.*

ii. Sori attached to a special vein parallel to the costa. (See also 20. *Drymoglossum*) . . 12. *Blechnum.*

iii. Sori not confined to the veins but spreading on to the parenchyma. Indusium 0 . . 25. *Stenochlæna.*

b. Sori on the fertile vein or terminal and then sometimes on a special marginal vein. Indusium proper rarely present but often formed by the margin of the frond (*Pteridee*) :—

i. Sori occupying the whole fertile vein excepting the ends (*Gymnogrammineæ*). Fronds hairy :—

Fronds 1–2-pinnate. Veins free . . . 13. *Gymnogramme.*

Fronds usually simple 3-lobed. Veins copiously reticulate and completely soriferous . . 14. *Hemionitis.*

ii. Sori occupying the ends of the veins only and sometimes confluent. Stipes polished black :—

† Sori not confluent on the inside of the recurved margins of the frond (*Cheilanthineæ*) :—

Veins thickened at the end, free . . 15. *Cheilanthes.*

Veins not thickened at the ends, anastomosing . . . . . 16. *Doryopteris.*

†† Sori confluent on the inside of the recurved margin of the lobes of the frond . . 17. *Adiantum.*

iii. Sori on an intramarginal vein connecting the ends of the normal veins. Veins otherwise free :—

Small palm-like fern with flabellate dichotomously divided fronds . . . . 18. *Actiniopteris.*

Fronds pinnately divided. No extrorse indusium . . . . . 19. *Pteris.*

As in *Pteris* but with a second extrorse indusium . . . . . *Pteridium* (p. 1204).

B. Indusium never present and margin of frond unmodified. Frond articulate on the rhizome. Venation never herring-boned. Sori dorsal on the frond, round or ellipsoid (linear or in lines in *Drymoglossum*) (Polypodiese) :—

1. Fronds simple undivided, fertile fronds contracted. Sori in a continuous line parallel to costa. Veins reticulate . . . . . 20. *Drymoglossum.*

2. Fertile fronds not contracted. Sori scattered :—

a. Fronds not dimorphic :—

Fronds glabrous or with simple hairs, veins free . *Polypodium.*

As in *Polypodium* but veins reticulate . . 21. *Pleopeltis.*

Fronds densely covered beneath with stellate hairs . . . . . 22. *Niphobolus.*

b. Fronds dimorphic. Barren sessile . . . 23. *Drynaria.*

II. Sori without indusium, densely covering both veins and parenchyma of the whole or part of the undersurface of fronds (*Acrostichee*) :—

A. Fronds simple dimorphic. Fertile much contracted :—

Veins much anastomosing with free included veinlets but often indistinct. Stipes not articulate . . 24. *Gymnopteris.*

Veins much as in *Gymnopteris*. Sori at first linear and parallel to costa, ultimately confluent. Stipes articulate on the wide creeping caudex . . . 20. *Drymoglossum.*

B. Fronds simple 3-lobed or pinnate, fertile not contracted. Sori at first confined to the copiously reticulate veins 14. *Hemionitis.*

C. Fronds pinnate, very large :—

Veins simple and forked free, very close. Pinnæ articulate, fertile pinnæ contracted . . . 25. *Stenochlæna.*

Veins copiously reticulate, fine and close. Pinnæ not articulate, fertile not contracted . . . . 26. *Acrostichum.*

1. NEPHRODIUM, *Rich.*

(Including *Goniopteris.*)

(*Lastrea* is sometimes included in this genus.)

Usually robust terrestrial ferns. Petioles not articulate on rhizome. Blade with both sides sub-similar, usually firm, rarely membranous, pinnate, rarely more compound, often more or less hairy. Indusium heart-shaped or kidney-shaped and attached laterally in the sinus, sometimes weakly developed or altogether failing. Venation entirely pinnate with one or more of the lower veinlets uniting with the corresponding one of the next group, not forming areoles except by the union of these 1–2 veinlets.

When the indusium fails the artificial genus *Goniopteris* results. Some pinnæ will show indusia and others not on the same plant.

I. Caudex widely creeping with fronds scattered, never dimorphic :—
  A. One–two veins each side of costules uniting :—
    1. Sori medial on the veins :—
      Frond herbaceous. Pinnæ lobed half-way down. Lower pinnæ reduced to auricles, veins 6–12 each side costule . . . . . 1. *molle*, var.
      Frond coriaceous. Pinnæ close, lobed one-third down, lower not reduced, veins 4–8 to each costule . . . . . 2. *unitum.*
    2. Sori terminal on the veins . . . . . 3. *pteroides.*
  B. Three to six veins each side of costule unite :—
    Pinnæ 3–5″ by ·3–·5″ lobed $\frac{1}{5}$–$\frac{1}{4}$ down, 3–5 veins unite . . . . . 4. *aridum.*
    Frond up to 8·5 ft. Pinnæ 6–10″ by ·7–1″, lobed $\frac{1}{4}$–$\frac{1}{3}$ down, 5–6 veins unite . . . . . 4. *aridum*, var.
II. Caudex finally erect or suberect, with the fronds tufted at the apex (or both scattered and tufted in *prolifera*) :—
  A. Fronds all erect, not dimorphic :—
    1. One to four veins only uniting, pinnæ lobed $\frac{3}{4}$ to half-way down :—
      Pinnæ 4–6″ by ·7–·8″, lobes sub-falcate. 1–2 veins unite . . . . . 1. *molle.*
      Pinnæ up to 10″ by 1·3″, lobes square often crenate, 2–4 veins unite . . . . . 5. *truncatum.*
    2. Veins 12–20, all but 2–4 uniting, lobes very short or 0 . . . . . 6. *moulmeinense.*
  B. Fronds di- or tri-morphic, barren often of unlimited apical growth creeping and ending in a flagellum with very small pinnæ. Veins 6–10 uniting . . 7. *proliferum.*

1. **N. molle,** *Desv.** Syn. N. parasiticum, *C. B. Clarke*; Polypodium parasiticum, *L.*

A tufted fern with the oblong-lanceolate fronds 1–3 ft. long, rarely 3·5 ft., simply pinnate with the pinnæ cut about half-way down or sometimes more deeply into rounded or sub-falcate lobes, variable in indumentum but nearly always more or less pubescent. Stipes and rhachis mostly pale, rather soft and becoming furrowed when dry, without scales except at the extreme base or scales very caducous,

* *Parasiticum* is apparently the oldest name, and the one which should be adopted under the international rules.

mostly minutely pubescent, and rhachis pubescent or hairy. Lobes of pinnæ with about 10–12 lateral venules or veins of which the 1–2 lowest meet in an intermediate venule. Sori one median on each venule down to the basal one, sometimes nearer the apices of the basal ones, ·04″ diam., with a kidney-shaped indusium, or indusium caducous.

A very common fern near streams in the forest in the dryer districts or along ditches in the open in the moister districts. Purneah! Santal Parg., *Gamble*! Singbhum, common! Angul, common!

Probably in all districts. Fr. all the year round in places.

Basal scales where present narrow, pointed, brown. Fronds rather thin for a *Nephrodium*. Pinnæ alternate, median 4–5″ by ·7–·8″, sometimes lobed as much as four-fifths way down, lowest distant often very short and sometimes reflexed, nervation never entirely glabrous. Indusium usually pubescent or pilose. Some Angul specimens are shortly hairy above.

Var. **procurrens,** *Baker* (sp. ?).

Root widely creeping with scattered fronds only 1–2 ft. long, oblong or lanceolate. Pinnæ soft close alternate 2–3″ long only, those at base short and deflexed or not, pilose with long white hairs both sides, cleft about ⅔ths down into falcate oblong segments; veins 5–7 each side of costule, only 1 uniting. Rhachis villose. Stipes with linear-lanceolate finely pointed scales at the base.

Often gregariously covering the ground under partial shade in Purneah, and is I think distinct from *molle*! Not in fruit.

2. **N. unitum,** *R. Br.**

Rhizome widely creeping. Stipes 1–1·5 ft. long, glabrous, black at base. Fronds about 1·5–2 ft. long with numerous very close pinnæ 3–5″ long by ·3–·5″ broad, cut down about one-third or a little more into triangular or ovate acute entire or subentire lobes, texture coriaceous, veins 4–8 each side of which lowest unites some distance below sinus and the next pair curving upwards sometimes unites with the excurrent vein; upper surface glabrous, under-surface generally very hairy. Sori medial on the veins, sometimes nearly coalescent and forming a continuous sinuous line round the pinna, indusium reniform, hairy.

A specimen named this in the *Cal. Herb.* from Sarguja, *Wood*, but it is poor and not in fruit and is possibly *aridum*. Abundant in tanks and places permanently wet in Bengal and probably in Purneah.

3. **N. pteroides,** *J. Sm.*

Resembles forms of *molle* and *unitum*. Rhizome wide-creeping. Stipes slender slightly scaly below up to 2 ft. Fronds 2–4 ft. long with larger pinnæ about 8″ by ·6″ (up to 12″ by 1″, *Bedd.*), lobed one-third to half-way down into rounded-falcate or triangular lobes, hirtellous on the nerves beneath; veins 7–10, of which lowest and sometimes also the next pair unite in an intercostal vein running to the sinus. Rhachis and both surfaces nearly naked. Sori terminal

* This is *N. unitum* according to *Beddome & Clarke, i. e. Polypodium unitum* (in their opinion) of *Linæuus*. But *Christensen* says this plant equals *N. gongylodes* and that *N. cucullatum, Baker*, is the *P. unitum, L.* In *N. cucullatum* the sori are at the apex of the veins, lower pinnæ dwindle to auricles and 3–5 veins unite.

on the veins forming a line all round the margin except at the sinuses, or sometimes only at the apex of the lobes (form *terminans*).

Balasore Hills, Orissa, *Blandford*!

4. **N. aridum,** *Don.*

A scarcely tufted fern, somewhat like *molle* but much more rigid and coriaceous, with narrower longer fronds usually 2–4 ft. and relatively narrower pinnæ which are only cut about one-fifth to one-third down into more or less triangular and acute lobules, usually 3–5 venules of each segment meeting one another. Sori usually closer, sometimes forming a continuous line each side of the vein half-way between vein and margin. Rhachis and lower surface pubescent or hairy, somewhat glabrescent with age.

Along streams. Ramnagar Hills, Champaran! Purneah, common! Wet places, Neterhat (Ranchi), elev. 3000 ft.! Fr. Oct.–Jan.

Fronds sometimes scattered on the creeping rhizome. Stipes dark or pale, 6–12″ long, not scaly, slightly pubescent. Pinnæ tapering from base to apex, alternate median 3″ by ·3″ (in middle) to 5″ by ·5″, rarely more in our area but attaining 9″ by 1″ elsewhere, lower pinnæ distant and much reduced. The acuteness of the lobes is mainly due to the margin being recurved at the upper edges.

In a form collected in Sarguja by *Dr. Wood*, labelled *N. unitum, R. Br.* (*Herb. Cal.*), the rhizome is very much creeping with the fronds arising 2–3″ apart.

Var. *α.* **pilosissimum.**

Frond 12–18″ with villosely-tomentose rhachis and pubescent stipes. Pinnæ very close, touching one another, median about 3″ by ·3–·4″ (in middle), very truncate at base, cut about one-fourth way down, surface hairy and with papillose glands beneath, strigosely hairy towards the tips of the lobes on upper surface with several pairs of venules uniting.

Neterhat!

The tomentum and glands are yellow in my specimens. Rootstock widely creeping. Lower pinnæ reduced to auricles. Except that some of the pinnæ have the lower 3–6 veins uniting this might be a variety of *molle* (var. *aureum, Clarke*? but the lower pinnæ are not reduced in *aureum* and the pinnæ are not at all contracted at their base as they are in that variety.)

Var. *β.* **maximum.**

A large fern of which the simply pinnate fronds sometimes reach 8½ ft. in length when clambering among bushes, but the pinnæ rarely over 10″ long by ·7–·8″ wide (in the middle), widest at base then nearly parallel-sided and finally tapering, pinnæ towards base of rhachis very distant and finally reduced to deltoid auricles ·3″ long only. Stipes naked, pale, grooved above, rhachis pale-brown, glabrous or puberulous. Pinnæ alt. and opposite cut about one-fourth way down into oblong rounded but shortly abruptly cuspidate lobes, which are connected below the cleft by a colourless membrane and finally a nervule, venules from each segment 10–12 each side, 1–2 lowest only really anastomosing with those of the next segment or intercostal vein. Costa of pinna above and veins and venules of the lobes beneath hirtellous, otherwise surface glabrous and somewhat

shining. Sori on each of the lower 6–7 median and subterminal venules, indusia deciduous.

Purneah! Fr. Nov.–Dec.

There is little in common between this plant and var. *pilosissimum*, but without further study of both in the field I am unwilling to make either a separate species.

5. **N. truncatum,** *Presl.*

A rather stout tufted fern with short erect rhizome. Stipes grey naked or slightly pubescent. Fronds firm, up to 4 ft. long, rhachis pubescent above or glabrous. Pinnæ numerous, 7″ by ·7″ (in my specimen, up to 11″ by 1·6″), long-acuminate, sessile or subsessile and sometimes obtusely cuneate at base, cut down about half-way to costa into oblong truncate sometimes obscurely crenated lobes sometimes dotted beneath, hirtellous on the venation beneath, sometimes hairy on the costa above. Veins 9–10, of which 2–4 each side unite. Sori usually on the 4–5 lowest veins, median or nearer the costule, indusium reniform.

Angul Forests! Fr. March-April. There is also a specimen called *truncatum* in the *Cal. Herb.* collected by *Gamble* in Palamau, but it has not been received and I have been unable to compare it.

6. **N. moulmeinense,** *Bedd.* Syn. Polypodium multilineatum, *Wall.**

A large fern with the simply pinnate fronds scattered on the creeping rhizome, 3–5½ ft. long, pinnæ subentire, crenulate or sharply falcately serrate, often with a large gland at the base, attaining 12″ by 1·5″, easily recognized by the strong parallel veins and the regular oblique venules, which are 10–20 each side uniting obliquely with an intermediate zigzag or nearly straight vein joining their apices.

Damp shady places, chiefly near rivers. Singbhum! Manbhum, *Camp.*! Hazaribagh (Parasnath)! Kalahandi! Fr. Nov.–Jan.

Stipes 2 ft. or more long, not scaly, rhachis slender, pale, puberulous. Pinnæ mostly 1–1·3″ broad in middle, scarcely tapering for half to three-quarters of their length, then caudate-acuminate, firm, with pale prominent costa beneath, shining and (in my specimens) minutely dotted, especially beneath, sometimes obscurely puberulous on the veins. Sori medial on the venules or nearer their apex, in a single row each side of the vein or costule. Indusiform reniform or rudimentary and evanescent.

7. **N. proliferum,** *comb. nov.* Syn. Goniopteris prolifera, *Presl.*; Polypodium proliferum, *Roxb.*

Fronds erect and tufted or creeping and clambering with long barren indefinitely growing simply pinnate fronds, erect barren fronds with lanceolate pinnatifid lobed or serrate apex, fertile fronds of definite growth and 1–2 ft. long, pinnæ 3–6″ long by ·5–·75″ wide. Often proliferous and pinnæ on the proliferous shoots gradually reduced to mere auricles towards the apex. Veinlets often wavy 6–10 each side of the veins meeting in an intermediate often very wavy vein. Sori medial on the venules, small round or oblong when young, usually becoming confluent in age, indusium 0.

Along river beds and ditches. Ranchi! Manbhum, *Camp.*! No doubt in many other districts. Abundant in Bengal and most parts of India near a perennial water supply. Fr. Nov.–Dec.

Rhizome stout, wide-creeping. Rhachis of barren fronds often rooting and

* But not *Wallich's Nephrodium multilineatum.*

bearing scaly bulbils from which new shoots spring. Pinnæ with bluntly lobed or crenate margins, sometimes deeply lobed at base, base truncate, rhachis and underside of pinnæ glabrous or slightly pubescent.

This is the only species of *Goniopteris* retained by *Beddome* in that genus. *Baker* and *Hooker* keep it in *Polypodium* where it was placed by *Roxburgh*. Although the habit and the sori are somewhat different from most of *Nephrodium* they seem to me insufficiently so to treat it differently from other species of *Goniopteris*.

2. LASTREA, *Presl.*

Characters of *Nephrodium* but none of the veins anastomosing. Fronds often very compound.

A. Fronds pinnate to 2-pinnate, nearly glabrous, at least above.
Sori glabrous :—
Barren and fertile fronds different, 2-pinnate or sub-2-pinnate.
Pinnæ up to 9″. Sori ·08″ diam. covering the fertile lobes . 1. *cochleata.*
Barren and fertile fronds similar, pinnate. Pinnæ up to 4·5″.
Sori ·03″ diam. not nearly covering surface . . . . 2. *calcarata.*
B. Fronds 2–4-pinnate, hairy both sides. Sori hairy . . . 3. *crenata.*

1. **L. cochleata,** *Bedd.* (*F.S.I.*). Lastrea filix-mas, *L.*; var. cochleata, *Bedd.* (*F.I.C.*); Nephrodium cochleatum, *Don.*

A tufted large fern with dimorphic fronds, barren sub-2-pinnate or pinnate and pinnatisect reaching 3½ ft. by 18″, ovate or oblong-lanceolate or broadly-lanceolate; pinnæ 12–18 prs. close, lowest often 8–9″ by 3″ oblong-lanceolate, pinnules lobed or not, denticulate or serrate, with translucent clavate ends to the nervules, nearly glabrous. Fertile fronds narrowly lanceolate and smaller, 2-pinnate, thickly covered on the somewhat concave under-surface of the oblong pinnules with the brown or grey indusia of the large sori which are ·08″ diam., each of which sometimes occupies a separate rounded toothed lobule of the pinnule.

A common fern on shady banks, and the Indian plains representative of the Male Fern (*L. filix-mas, L.*). Purneah! Santal Parg.! Ranchi and Palamau, common at 3000 ft.! Hazaribagh, ascending to top of Parasnath! Manbhum, *Camp.*! Angul! Mayurbhanj! Fr. Sept.–Jan.

Rhizome woody very stout horizontal and ascending, thickly covered with the old leaf bases and with large brown shining scales. Stipes pale shining 6–12″ in the barren, sometimes 2 ft. long in the fertile frond, base with brown fibrillæ and linear or lin.-oblong scales ·2–·4″ long similar to those on rhizome. Rhachis terete, grooved above, firm, glabrous, or with a few fibrillæ and hairs which may also occur on the secondary rhachises esp. in the fertile frond; sec. rhachis in bar. fr. nearly always more or less winged by decurrent blade. Basal pinnæ spreading or somewhat reflexed in bar. fr., in fertile frond erect, pinnæ of fer. fr. 7–12 prs. (exc. subsidiary lobes), not exceeding 3–4″; pinnules of bar. fr. oblong or ovate-oblong attaining 1·5″ by ·5″ when lobed, or usually about 1″ by ·25–·3″ when merely serrate; of fer. fr. rarely over ·6″ by ·15″ and often only ·15″ long and broad, lobules often spinulose serrate. The barren frond occasionally bears a few sori which are generally smaller than those of the fer. fr. Indusia persistent orbicular-nephroid with sinus quite closed, glabrous.

The rhizome does not appear to be used.

Var. **marginata**, *Hope.* Barren fronds deltoid completely 2-pinnate at base with sec. pinnæ cut four-fifths down into oblong serrate segments. Meghasani, elev. 3500 ft.!

2. **L. calcarata,** *Bedd.* Syn. Nephrodium falcilobum, *Hook.*

A tufted fern from 8″ to 2 ft. high. Fronds lanceolate or oblong-lanc., pinnate with the pinnæ pinnatifid or pinnæ only lobed, in one

variety (*falciloba*) with many reduced pinnæ or auricles on the stipes. Pinnæ 1–4·5″ long by ·2–·7″ wide, cut down two-thirds or more (or in small forms less), into oblique falcate linear-oblong segments, the upper basal one often considerably longer than the others and resembling the auricles. Rhachis pubescent or hairy and under-surface of frond glabrous or hairy. Veinlets 3–8, simple, sori ·03″ diam. medial with usually a well-developed orbicular (nephroid) indusium, becoming shrivelled with age, one medial on each veinlet or (in small forms) only a single line on each side of the costa of the pinna (*i. e.* only on one veinlet of each segment).

Near streams. Singbhum! Hazaribagh, *Wood*! Fr. April.

Caudex or rhizome small (in my specimens, stout, *Bedd.*), erect, with many fibrous roots. There are two varieties in our area:—

Var. *α.* **falciloba**, *Clarke*. A very pretty fern with fronds up to 2 ft., deeply pinnatifid and many erect auricles on the stipes, textures subcoriaceous.

Var. *β.* **sericea**, *Bedd.*? A much smaller plant with much more hairy rhachis also hairy on the veins and venules beneath. Pinnæ less deeply lobed and lobes slightly falcate. Lowest pinnæ deflexed, auricles 0. It may be merely a young plant but is in fruit.

3. **L. crenata,** *Bedd.* Syn. Polypodium crenatum, *Forsk.*; Nephrodium odoratum, *Baker*; Dryopteris crenata, *Christ.*

A very pretty fern with glossy stipes 12–18″ long with a tuft of lanceolate golden scales at the base. Frond 9–18″ long, deltoid, 3–4-pinnate. Lowest pinnæ largest lanceolate-deltoid, 6–9″ long by 3–4″ wide at base. Pinnules lanceolate very crowded with ovate or oblong pinnatifid segments with blunt rounded lobes, texture softly herbaceous. Frond hairy or viscous villous both sides especially on the rhachides. Sori with large pale villous indusium.

Parasnath, among rocks, *J.D.H.*! Fr. Sept.–Oct.

3. POLYSTICHUM, *Roth.*

Usually very beautiful, generally terrestrial ferns. Fronds coriaceous, mostly pinnate, pinnæ usually stronger on the acroscopic side, ultimate teeth usually awned, venation pinnate simple with all veins free. Sori orbicular dorsal or rarely terminal on the veinlets, indusium peltate, seldom failing. Spores bilateral.

1. **P. aculeatum,** *Sw.*

A stout handsome tufted fern with the stipes very scaly and fibrillose throughout, the scales and fibrillæ extending more or less on to the frond. Fronds 2–3 ft., lanceolate, bipinnate or sub-bipinnate, coriaceous with numerous close lanceolate pinnæ, the lower about 5–6″ in our form. Pinnules subrhomboid-oblong, unequal at the base, basiscopic margin excised, upper (acroscopic) more or less auricled, ·5–·6″ long, spinulosely crenate-serrate and with spinulose tip. Sori towards the apex of the lower veinlets.

Parasnath, *Clarke*! Fr. April.

The fern is very variable. The form described is nearly typical or near var. *lobatum*.

4. ASPIDIUM, *Swartz.*

Mostly fairly large ferns. Petiole not articulate on rhizome. Fronds very various, from simple to 3-pinnatifid, often membranaceous and flaccid with pinnæ frequently strongly developed on the basiscopic side, veins freely branched and much anastomosing with generally free included veinlets in the areoles. Sori roundish, on a rather prominent receptacle. Indusium orbicular, more rarely reniform or irregular or obsolete. Spores bilateral.

1. **A. cicutarium,** *Sw.* Syn. Nephrodium cicutarium, *Hk. & Baker.*

A tufted fern with the fronds rather membranous, often 2·5–3 ft. long and somewhat deltoid in outline, pinnatifid or pinnate below with the pinnæ deeply pinnatifid, rarely 2-pinnate or more compound. Sori ·04–·06″ diam. with a reniform or usually peltate indusium in a row each side of the vein of the final lobe or segment, at the apex of the free venules or compital.

Shady banks in the forest. Common in Chota Nagpur. Singbhum! Parasnath (Hazaribagh)! Ranchi! Palamau! Fr. Nov.–Jan.

Stipes under 1 ft., deep chestnut-brown, with few oblong scales or many close to the base; flattened. Main rhachis and primary partial rhachides beneath glabrous or nearly so. Free pinnæ usually 3–5 prs. sub-opposite. Final lobes rounded or if acute then again crenate.

Var. **coadunata,** *Wall.*

This has slightly thicker (but still thin) fronds which are pubescent above and on the nerves beneath, rhachis hairy. The common form in Singbhum!

Note.—**A. variolosum,** *Wall.*, is recorded in *Bengal Pl.* from Ch. Nagpur. I consider the specimens so named are *A. cicutarium* with more pronounced reticulate venation. The fertile fronds of *A. variolosum* have narrower pinnæ and are unlike the barren fronds but the two species appear to pass into one another.

5. NEPHROLEPIS, *Schott.*

Rhizome short or widely creeping or climbing, sometimes with bulbils. Stipes not articulate to rhizome. Fronds clustered with indefinite apical growth, simply pinnate with sessile linear or oblong undivided pinnæ articulate on the rhachis and usually stronger on the acroscopic side; veins forked, free, their ends clavate and calcareous on the upper side (showing as white chalky dots). Sori distinct, orbicular, arising from the apex of the upper branch of a vein generally near the margin and furnished with a reniform or suborbicular extrorse indusium, appearing as a single row parallel to the margin or costa.

Not stoloniferous. Pinnæ 1·5–3″ long.	Sori sub-marginal .	. 1. *exaltata.*
Stoloniferous. Pinnæ under 1·5″ long.	Sori sub-median .	. 2. *cordifolia.*

1. **N. exaltata,** *Schott.*

A tufted fern with suberect rhizome and linear-oblong weak pinnate fronds up to 3 ft. long with firm slightly scaly pale-coloured stipes 4–8″ long. Rhachis from densely fulvous hairy to nearly glabrous. Pinnæ mostly close 1·5–3″ long by ·25–·4″ broad, acute or subobtuse or lowest shorter broader and rounded at apex; base on the acroscopic side with an oblong auricle, on the basiscopic side with

a smaller rounded one; margin entire or crenate or sub-serrate, glabrous both sides or very scaly when young or lower surface hairy. Sori in a line quite close to the margin with firm reniform (or orbicular but attached on one, the inner, side), ·04″ diam.

Bonai, *Grieve*! Very frequently cultivated in pots. Fr. May–July. *Grieve* described his specimen as climbing, but it appears to be *exaltata* (which is common in some of the Central Provinces' hills!) with rather more rambling fronds than usual.

Young unfolded fronds covered with dense dark subulate scales.

2. **N. cordifolia,** *Presl.*

A tufted fern developing long rooting stolons especially in wet places on which are produced stalked hairy and scaly brown bulbils or tubers up to ·5″ diam. or more. Fronds 1–2 ft. long, linear or linear-oblong with a wiry slightly scaly or hairy stipes 1–4″ long. Pinnæ very crowded, with the acroscopic auricle often overlapping the top of the rhachis and the base of the next pinna, attaining 1–1·3″ long by ·3–·6″ broad but usually much smaller and the basal ones reduced to broadly oblong or orbicular superiorly lobed auricles, apex of pinnæ mostly rounded, margin entire or slightly crenate, base truncate or cordate, surfaces nearly glabrous, the cretaceous dots often conspicuous as small discs. Sori nearly equidistant from margin and midrib, ·04″–·05″ diam., indusium persistent, nephroid with broad sinus or attachment base.

On moist shady banks and hillsides. This occurs often in association with *N. exaltata* in the Central Province's mountains and will probably be found in the western mountains of our area. It is very frequently seen in cultivation in grass greenhouses and verandahs. Fr. April–July.

6. HUMATA, *Cav.*

(Includes *Leucostegia, Presl.*)

Ferns with creeping rhizome, growing usually on trees and rocks. Stipes scaly, articulate to the scaly rhizome. Frond coriaceous (*Humata*) or membranous (*Leucostegia*) 1–4-pinnate or -pinnatifid; veins simple or forked with free venules. Sori terminal marginal on the underside of the margin with a sub-orbicular or reniform thin or coriaceous indusium attached by a broad base but free at the sides and apex. Receptacle minute.

Scales slender. Frond 2–3-pinnate. Ultimate segments obovate, lobulate crenate or dentate . . . . . 1. *immersa.*
Scales broad rounded. Frond 3–4-pinnate. Ultimate segments lanceolate deeply cut into few short linear lobes . . . . 2. *pulchra.*

1. **H. immersa,** *Diels.* Syn. Leucostegia immersa, *Hk.*; Davallia immersa, *Wall.*; Davallia multiflora, *Roxb.* (*Beng. Pl.*).

A very pretty fern with the rhizome mostly underground, creeping, on the exposed parts covered with slender scales or fibrillæ. Fronds 2-pinnate and pinnatifid or 3-pinnate, ovate in outline, 4″ by 2″ to 9″ by 4–5″ with a polished glabrous erect pale brown stipes 6–8″ long. Secondary pinnæ with slender stalks, in our specimens only pinnatifid

or pinnatisect with the pinnules somewhat dimidiately obovate lobed and either (usually 3-) lobulate or coarsely crenate at the tips. Sori large, with the base of the semi-orbicular membranous indusium ·06–·07″ diam., impressed and hence clearly visible on the upper side, the sporangia when ripe usually projecting beyond the margin, usually 1–6 sori to a pinnule or segment and lower pinnules often barren.

Hazaribagh, repeatedly collected on the top of Parasnath 4000 ft. ! but nowhere else in our province. Fr. Sept.–Nov.

2. **H. pulchra,** *Diels.* Syn. Leucostegia pulchra, *Bedd.*; Davallia pulchra, *Don*; Davallia chætophylla, *Wall.*

A very beautiful fern with wide creeping rhizome clothed with broad rounded often peltately attached scales. Fronds glabrous very delicately 3–4-pinnate or (from the rhachides being narrowly winged) -pinnatifid, ovate or sub-deltoid in outline, 5–15″ long by 3·5–8″ broad and with a slender naked stipes 4–8″ long. Ultimate pinnules ovate or elliptic pinnatifidly cut into lanceolate segments with few short linear mostly very acute lobes. Sori mostly broader than long sub-marginal, ·02″ diam.

On rocks and trees. Rare. Parasnath, *J.D.H.* ! Fr. Sept.–Oct.

7. MICROLEPIA, *Presl.*

Rhizome creeping, hairy. Fronds scattered or 2-ranked along the rhizome, not articulate, 1–more pinnate, veins simple or pinnately forked with branches or venules free. Sori terminal on the dilated end of the venule which forms an evident receptacle often visible from the upper surface, marginal or intra-marginal. Indusium membranous, semi-cup-shaped, attached by base and sides. Sporangia very numerous.

Fronds simply pinnate, nearly glabrous . . . . . 1. *marginalis.*
Fronds 2–3-pinnate, hairy both sides . . . . . 2. *speluncæ.*

1. **M. marginalis,** *Hance.* Syn. Davallia marginalis, *Baker.*

Fronds simply pinnate and lobed, lanceolate or linear-lanceolate to broadly ovate-lanceolate (*Bedd.*), firm, 18–24″ long by 6–12″ broad (9–15″, *Bedd.*), and with a grey scaberulous nearly glabrous stipes 8″ or more long. Rhachis and costæ beneath closely pubescent. Lowest pinnæ reduced to 2–3 rounded toothed pinnules. Median pinnæ longest, attaining (in our specimens) 6–7″ by ·7–·9″ linear-lanceolate acuminate, shortly stalked, obliquely cuneate and much stronger on the acroscopic side of the base, lobed half-way down except on the serrate acuminate apex, lobes broadly oblong rounded rarely acute, crenate or dentate, each lobe with a pinnate or sub-dichotomously branched vein, the venules sometimes again divided in the larger lobes, fertile venules expanded at the tip into a receptacle visible and appearing brown from above. Sori solitary opposite the sinuses of the acuminate apex and intra-marginal, 2–5 sub-marginal on the lower lobes, ·06″ diam., margin of indusium slightly crenate and sparsely

hairy (densely villous in the type, our plant is probably var. *calvescens, Hook.*).

Mayurbhanj, elev. 3500 ft.! Fr. May–June.

2. **M. speluncæ,** *Moore.* Syn. P. speluncæ, *L.*; M. strigosa, *Sw.*; var. flaccida, *R. Br.* (sp.); Davallia polypodioides, *Don*; M. Khasiyana, *Fen.*

A large handsome fern 4–5 ft. from root to apex of fronds, caudex short erect with capillary scales. Stipes scaberulous with hard-based hairs, more or less glabrescent and glossy, 1–2 ft. long. Frond 2–3-pinnate and pinnatifid, rather flaccid, hairy both sides. Pinnæ longest about one-third from the base and attaining 18″ with sec. pinnæ about 3″, but often much smaller and then secondary pinnæ not again pinnate but only cut to the winged rhachis into broadly oblong lobulate and crenate lobes; lobes with long white hairs beneath and more sparsely hairy above, broadly oblong rounded with a 2-chotomously branched vein, margin sometimes recurved. Sori few, ·03″ long and broad, often only 1–2 or up to 6 on a lobe close to the margin and usually at the sinus of a lobule or crenature.

Purneah! Fr. Dec.–Jan.

This is not at all typical *strigosa*, but I am not quite sure whether it is *Clarke's flaccida*. *M. strigosa* has a very characteristic densely substrigosely indumentum on rhachis and costæ. Our plant closely resembles the plate of *Davallia Khasiyana* in *Lowe's Ferns* (pl. 32) except that the margins of lobes are bluntly crenate rather than toothed. It also agrees with a specimen marked *Davallia proxima, Thw.*, at Kew! The fronds are more flaccid than in most of this group. *Clarke* (*F.N.I.*, p. 448) says that *Bentham* has apparently included under *Davallia speluncæ* the whole of *D. polypodioides* as well as *D. flaccida, R. Br.*, and he suspects that this is the course which ultimately pteriodologists will take.

8. ODONTOSORIA, *Presl.*

(Includes *Stenoloma, Fee.*).

Stipes often tufted, not articulate on the rhizome. Fronds very pinnately compound or decompound with forked free veins. Sori terminal on the segments, on the tips of the venules but these are not expanded into an evident receptacle, the indusium forming together with the slightly modified opposed lobe of the frond a compressed cupular pouch only open at the top.

1. **O. chinensis,** *J. Sm.* Syn. Stenoloma chinensis, *Bedd.*; Trichomanes chinensis, *L.*; Davallia tenuifolia, *Sw.*, and D. chinensis, *Sw.*

A very beautiful and graceful fern with fronds tufted on the creeping rhizome which is covered with shining brown scales. Stipes glabrous shining brown 8–18″ long, fronds (without stipes) 1–2 ft. long by 6–9″ broad, ovate or lanc.-ovate or lanceolate in outline, 3-pinnate with pinnules cut into linear-obcuneate forked segments bearing 1–2 rarely confluent sori at their expanded tips. Pinnæ rather distant, alternate, ovate or lanceolate. Rhachis flattened and grooved above, that of the pinnules zigzag.

Banks of streams in the Saranda forests, Singbhum! Udeypur, *Prain's Collector*! Fr. Feb.–May.

9. ASPLENIUM, *L.*

Ferns of various habit. Stipes not articulate to the rhizome, with 1 or 2 vascular bundles which unite above into a central more or less cylindrical or 4-gonous strand. Scales with thick-walled cells, the walls mostly coloured red-brown, the lumen colourless; usually the median cells are narrower and simulate a nerve. Frond undivided, pinnate, or more rarely 2–4-pinnate, pinnæ or segments commonly more developed on the acroscopic side. Veins free. Sori straight, linear, attached laterally to the fertile vein on one side only (*cp. Diplazium*), indusium introrse. Spores bilateral.

A large genus which, even shorn of the allied genera *Athyrium*, *Diplazium*, *Anisogonium*, etc., numbers some 150–200 species, very badly represented in our area. The character of the scales is not well marked in our species but is very distinctive in some and can be seen with an ordinary pocket lens. In other cases it can be seen if the scale is mounted in a little dilute glycerine on a slide.

1. **A. laciniatum,** *Don.* Var. depauperata, *Clarke.*

A small tufted fern 6–10″ high. Fronds linear-oblong about 1–1·5″ wide, pinnate with numerous alternate or subopposite rhomboid or semi-ovate stalked pinnæ rather irregularly laciniate less than half way down parallel to the flabellately arranged nervation, base much cut away on the basiscopic side. Stipes with linear scales, rhachis upwards glabrous or very sparingly scaly. Sori linear ·1–·2″ long on many of the veins.

Parasnath, *J.D.H.*! Fr. Oct.

10. ATHYRIUM, *Roth.*

Usually tufted ferns. Stipes not articulate on the rhizome, with 2 vascular bundles below uniting into a crescent-shaped bundle above. Scales of one layer of thin-walled cells. Frond 1–many-pinnate, segments short, toothed. Veins free. Sori mostly solitary on a raised flat receptacle placed laterally on the fertile vein, short or elongate, more or less curved, sometimes hooked, indusium present and of same shape as sorus but sometimes evanescent or rudimentary, introrse, usually straddling over the fertile vein. Spores bilateral.

Straight oblong or linear-oblong sori often occur in some species together with curved ones or sometimes without curved ones; the sori then resemble those of *Asplenium*, to which genus it is in fact often united and is somewhat artificially separated. The walls of the scale-cells are sometimes of moderate thickness, but thin if compared with a good example of *Asplenium*.

Fronds 2–3-pinnate, or if 1-pinnate then pinnæ deeply pinnatifid.
Sori ·02–·04″ long . . . . . 1. *filix-femina.*
Fronds 1-pinnate, pinnæ not lobed more than half-way down.
Sori ·1″ long . . . . . 2. *falcatum.*

1. **A. filix-femina,** *Roth.* Syn. Asplenium filix-femina, *Bernh.* Lady-fern.

A very beautiful finely-cut (except var. *parasnathensis*) tufted fern 1–4 ft. high. Stipes grooved, one-third to nearly as long as rest of frond with scattered linear membranous deciduous scales. Frond lanceolate narrowed both ends, membranous, green, 2–3-pinnate (sub-2-pinnate in var.) and pinnatifid, with soft rhachis appearing triangular or furrowed when dry. Pinnæ narrowly linear-oblong or

linear-lanceolate, widest near the base, secondary pinnæ ·25–1″ long oblong or linear-oblong spreading at right-angles to rhachis, sessile or decurrent, pinnatifid or serrate (or pinnate in var. *pectinata*), margin toothed. Sori usually very small, shortly oblong (sometimes almost quadrate), only slightly curved, usually in two rows on the ultimate pinnules or lobes, ·02–·04″ long.

Damp localities in the higher hills. Ranchi (Pitorea East Hill), *Wood*! Hazaribagh, Parasnath! Fr. Sept.–Dec.

The following varieties occur in our area :—

Var. *α.* **pectinata,** *Clarke.* Syn. A. pectinata, *Wall.*

Very finely tripinnate and ultimate pinnæ pinnatifid with very acute or subspinulose teeth. Rhachis slender but scarcely grooved when dry. Indusium very shortly oblong subpersistent.

Ranchi and Parasnath.

Var. *β.* **parasnathensis,** *Clarke.*

Fronds 1-pinnate, sub-2-pinnate. Rhachis triangular when dry. Fronds reddish, 1·5 ft., narrow oblong, scarcely attenuate at base. Primary pinnæ 1·5″ long broadest at the base, sec. pinnæ ·25–·3″ acutely toothed, scarcely pinnatifid. Indusium short oblong, in two oblique rows, very persistent. Parasnath, *Clarke.*

2. **A. falcatum,** *Bedd.*; Syn. Asplenium drepanophyllum, *Baker.*

A tufted fern with linear-lanceolate 1-pinnate fronds narrowed to both ends 3–12″ long by 1–3″ broad; stipes up to 6″ in the larger fronds. Pinnæ ·2–·5″ broad, median cut half-way down into broadly oblong rounded lobes usually with a distinctly larger basal lobe on the acroscopic side, lower pinnæ sometimes more deeply cut, lobes entire or toothed. Stipes with many very slender scales near the base, rest of frond glabrous. Sori usually in one row each side of the costa of the pinna, about one to each lobe on its upper venule, oblong, about ·1″ long but sometimes very broad.

Ranchi, *Wood*! Palamau, 2000 ft., *Gamble*! Hazaribagh, 4000 ft. (Parasnath)! Fr. Sept.–Dec.

Pinnæ spreading or deflexed. *Beddome* says that the sori are numerous on each side of the costa, at length confluent and covering the whole or nearly the whole under-surface. They are distinct in our specimens and have quite the shape of many *Asplenium*, in which genus it is often placed.

11. DIPLAZIUM, *Sw.*

(Including *Anisogonium, Presl.*)

Ferns of various habit. Stipes not articulate, with 2 vascular bundles which unite above into one peripheral semi-cylindric strand. Fronds simple to very compound. Nerves free or (section *Anisogonium*) some anastomosing. Sori dorsal straight linear as in *Asplenium*, but usually at least one (the basal acroscopic) veinlet in each lobe bears a sorus both sides; the other veinlets have a sorus on one side only or *nil*. Indusium usually coriaceous; in the twin sori both open outwards from the veinlet. Scales as in *Athyrium*.

1. **D. esculentum,** *Sw.* Syn. Anisogonium esculentum, *Presl.*; Asplenium esculentum, *Retz.*

A large fern with an erect stout caudex and a terminal tuft of

mostly 2-pinnate fronds 3–5 ft. long, including the 1–2 ft.-long pale slightly scaly stipes which is more or less 4-angled and grooved. Scales dense near the rhizome lanceolate-acuminate, ciliolate with papillæ. Barren fronds almost dimorphic, either simply pinnate with the pinnæ 2–3·5″ long or very broad and 2-pinnate (on same plant), with the pinnæ 6–12″ long alternate and rather distant, fertile fronds similar to the second form, secondary pinnæ 1–4″ long by ·4–·7″ wide in middle, lobed $\frac{1}{4}$–$\frac{1}{3}$ way down or only notched, basal lobes often much longer than others, margin crenate-serrate. Vein (one to each lobe) with 5–6 oblique veinlets, of which 2–3 meet in an included intermediate vein (much as in *Nephrodium*); occasionally also there is a little anastomosis near the edges of the lobes. Sori linear ·05–·12″ long, one to each venule except the 1–2 terminal.

Frequent in marshy places. Purneah! Singbhum! Ranchi (3000 ft.)! Palamau, near rivers! Mayurbhanj, 3500 ft.! Fr. Dec.–Jan.

Fronds more or less puberulous and papillose beneath, sometimes pubescent on the costæ, slightly scented, the hairs apparently slightly glandular. The scales are moderately thin-walled as in *Athyrium* with lumen slightly coloured, all cells very narrow, but without any apparent midrib.

The young fronds are cooked and eaten.

12. BLECHNUM, *L.*

Rhizome usually erect. Stipes with 2 strong and several smaller vascular bundles; scales with thin-walled cells. Fronds tufted uniform or slightly dimorphic, simply pinnate or pinnatifid; veins in the barren fronds all simple free and parallel or uniting in a marginal vein only, or forked; in the fertile frond similar but with a transverse veinlet (sometimes very obscure) running parallel to and close to the costa and connecting up the veins usually just at their point of forking. Sori forming a continuous line each side of, close to the costa covering the connecting veinlet, with a continuous introrse indusium.

1. B. orientale, *L.*

A large fern with an erect stout caudex clothed with fibrillose dark brown scales. Fronds up to 4 or 5 ft. in length, simply pinnate. Pinnæ sessile entire linear with caudate tips, longer attaining 12–18″ long by ·5–·9″ wide, uppermost only with decurrent bases (making the top of the frond pinnatifid), others with base rounded on the basiscopic half-cuneate on the acroscopic side; veins very close parallel meeting and slightly upcurved in the margin, a few only forked. Sori forming a continuous line from the base nearly to apex of pinna.

Very common near streams. Purneah! Singbhum! Ranchi! Palamau, *Wood*! Mayurbhanj! Fr. all the year round.

The lowest pinnæ are reduced to small rounded auricles on the stipes.

13. GYMNOGRAMME, *Desv.*

(Includes *Neurogramme* part, *Diels.*)

Fronds various, not articulate to the rhizome, one–several-pinnate, the under-surface more or less thickly hairy often with white waxy

hairs (as in *Cheilanthes*), veins pinnate or forked or both, free, or with an occasional union. Sori linear occupying the whole length of the veins but leaving the ends free.

1. **G. calomelanos,** *Kaulf.* Syn. Neurogramme calomelanos, *Diels*; Ceropteris calomelanos, *Und.*

A pretty fern with 2-pinnate fronds 2–3 ft. long, lanceolar in outline with lanceolate pinnæ up to 3–4″ long and narrow linear-lanc. pinnules cut at the base into small oblong lobes and crenate towards the apex. Under-side of fertile fronds white and mealy with intermixed black sporangia. Stipes dark shining chestnut with linear acuminate brown scales towards base. Veins close oblique, often twice forked. The sporangia have a golden annulus but appear black before bursting from the black spores.

Ditches and banks, Purneah (near Thakurganj)! Fr. Dec. One of the "Gold and Silver Ferns." This is a native of America, tropical West Africa on the islands, and has also been reported from Samoa! Its distribution is therefore remarkable, and it is remarkable that it should occur near Thakurganj with every appearance of being wild as, although it is sometimes cultivated, there are no signs of its being so in that locality (a small village without gardens). It has also been collected in a gully above Tista bridge near Pashok (*Herb. Lacaita*, 21.4.13).

14. HEMIONITIS, *L.*

Small ferns with erect or prostrate rhizome. Stipes not articulate. Frond simple or lobed, rarely pinnate, usually hairy, veins copiously anastomosing and forming numerous areoles with rarely a free veinlet in them, which when present is also soriferous. Sori continuous along the veins and copiously reticulate. Indusium 0.

1. **H. arifolia,** *Bedd.*

A small tufted fern with cordate ovate or hastate fronds; barren ones 2″ by 1·5″ to 6″ by 3·5″ with lobes rounded at the apex, fertile fronds often as broad as long, more hastate and with acute lobes, stipes of fertile frond 8–12″ long, chestnut brown, fibrillose towards the base, young hairy all over, of barren frond only 2–4″ long. Blade coriaceous, with thin long hairs beneath, venation obscure. Sporangia densely covering under-surface but following the reticulate veins, the costa of the lobes alone more or less bare.

Growing in the crevices of bare rocks. Ranchi (Horhap forest, etc.)! Puri, on Khandabolo Mnt.! Also Chilka Lake Islands, *C. & N.* Fr. Oct.–Jan.

15. CHEILANTHES, *Sw.* Silver-fern.

Usually small ferns with short erect or creeping scaly rhizome. Stipes not articulate, generally clustered. Frond 3–4-pinnate or pinnatifid, rarely only once pinnate and pinnatifid, more or less hairy or papillose, the hairs or papillæ often white-waxy and mealy, veins free. Sori terminal on the thickened ends of the veins, roundish or extending into a linear form and more or less confluent. Indusium 0, but the sori often more or less covered by the somewhat modified at

length partially or wholly recurved margin of the frond. Spores roundish-tetrahedral.

Frond not covered with white papillæ beneath. Sori extending some distance from margin . . . . . 1. *tenuifolia.*
Frond pure white with waxy papillæ beneath. Sori only forming a line round the margin . . . . . 2. *farinosa.*

1. **C. tenuifolia,** *Sw.*

A small very pretty fern with shortly creeping scaly caudex; stipes more or less tufted deep brown or black, those of the fertile fronds much longer than of the barren. Barren fronds mostly 3–4″ deltoid, 2–3-pinnate, pale beneath but not white-mealy, nearly glabrous, sparsely hairy above. Fertile fronds usually more elongate up to 12″ or 18″ long including the stipes, otherwise similar. Lowest one or two pairs of pinnæ longest, 2–4″, with the lowest basiscopic secondary pinnæ often twice as long as the others and pointing backwards, ultimate pinnules with small elliptic lobes ·1–·2″ long only, the larger crenate. Rhachis winged above. Sori submarginal on the crenatures, ultimately confluent, margin of the lobes more or less recurved.

On moist banks. Ranchi! Hazaribagh, *Gamble*, *Clarke*! Manbhum, *Camp.*! Singbhum! Frequent throughout Chota Nagpur. Puri (Barkuda I.), *C. & N.*; Sambalpur, *Griff.*! Fr. Sept.–Nov. *Beddome* calls it annual, but although it appears to curl up and die in the hot season, I think it is usually perennial.

2. **C. farinosa,** *Kaulf.*

A very pretty small tufted fern with more or less elongated black or chestnut glossy stipes, sealy when young. Frond (with the stipes which is usually about the same length as the blade) 4–20″ long, smaller usually somewhat deltoid, larger usually lanceolar in outline, underside covered with a beautiful white indumentum of small waxy papillæ, usually 2-pinnate and pinnatifid. Lowest primary pinnæ longest, 2–4″, with the lowest basiscopic secondary pinna two–three times longer than the others and generally pointing backwards, pinnatifid with oblong rounded lobes. Sori at first small globose in an almost continuous line close to the margin, finally confluent. Edge of frond thin and simulating an indusium, sometimes covering the sori.

Ravines and damp hillsides, very common in the hill districts. All districts of Chota Nagpur, ascending to top of Parasnath! Rajmahal Hills! Angul, *Chattarjee*! Fr. Sept.–Jan.

16. DORYOPTERIS, *J. Sm.*

Rhizome short or creeping, the black polished stipes clustered or scattered with diarch or triarch vascular bundles, scales with pronounced central band. Fronds often dimorphic, simple or pinnatifid, and the basiscopic side of segments more strongly developed; triangular ovate in outline. Veins copiously anastomosing without free included veinlets. Sori marginal as in *Pteris.*

1. **D. ludens,** *J. Sm.* Syn. Pteris ludens, *Wall.*

A small fern with creeping rhizome furnished with linear adpressed, white-margined brown scales. Stipes scattered, with sparse scales

and sometimes pubescent at base and apex, that of barren frond 3–4″, of fertile up to 12″. Barren frond triangular-ovate simple entire with somewhat cordate or hastate base, 2–4″ long and 1–2·5″ broad, basal lobes sometimes sub-2-lobed. Fertile frond 4–6″ each way, ivy-leaf shape or pinnatifid with the basal lobes furcate, the basiscopic fork deflexed, other lateral lobes 2 only, lobes all linear or linear-lanceolate entire coriaceous, costæ black polished, other venation obscure.

Balasore Hills, *Blandford*! Fr. Feb. Common in Burmah.

17. ADIANTUM, *L.* Maidenhair.

Usually tufted ferns with black and polished inarticulate stipes, almost always with one half-cylindric vascular bundle. Fronds generally bright green and of delicate texture, simple to much pinnately compound with the final pinnules usually short broad and rounded with flabellate venation. Veins mostly simple or forked free. Sori marginal, globose to linear, at the ends of the veins, and often spreading on to the parenchyma, separate or confluent and covered by the recurved lobulate margin of the frond, on to which they extend.

Stipes naked. Pinnæ with slender petiolules half-orbicular or somewhat oblong, acroscopic margin entire or with rounded lobules . 1. *lunulatum.*
Stipes pubescent or tomentose. Pinnæ subsessile half-lanceolate or half-ovate, the acroscopic margin deeply lobed or laciniate . . 2. *caudatum.*

The well-known true Maidenhair fern (*A. capillus-veneris*) has been found by me on wet rocks in mountain ravines of the Central Provinces and might perhaps occur in our area.

1. A. lunulatum, *Burm.* Dodhari, *S.*

A tufted fern with slender fronds 6–15″ long including the black polished nearly glabrous wiry stipes, alternate patent petioled semi-orbicular or elliptic-oblong simple pinnæ with straight basiscopic edge and curved lobulate acroscopic edge, ·5–1·3″ long, acroscopic base produced and rounded, nerves flabellate forked, sporangia on the recurved lobules or sometimes continuous margin. Stalks of the pinnæ filiform ·1–·4″ long, and rhachis black and polished like the stipes. Rhachis usually ends in a symmetrical flabellate pinna. Only in one case have I seen it produced into a flagellum as in the next species.

A common fern in shady hill forest. Santal Parg., *Gamble*! Throughout Chota Nagpur! Angul, *Chattarjee*! No doubt throughout the hilly districts. Fr. July–Jan.
A decoction of the root is given in throat affections by the Santals, *Campbell.*

2. A. caudatum, *L.*

A small tufted fern with very fibrillose rhizome. Fronds linear or linear-oblong 6–16″ long, including the wiry polished deep-brown stipes, up to the termination of the leafy portion, beyond which the rhachis is frequently extended into a long more or less bare flagellum of indefinite length often rooting at the tip. Pinnæ all quite free subsessile or shortly petioled, more or less rhomboid or irregularly

oblong in outline, nearly straight on the basiscopic side, more or less lobed or deeply laciniate on the acroscopic side and tip, flabellately nerved. Stalks of lower pinnæ up to ·1″, usually less, upper subsessile. Rhachis and stipes more or less pubescent or tomentose. Sori at the ends of the segments, never forming a continuous line.

Damp hillsides and ravines, common. Ranchi! Palamau, *Gamble*! Singbhum! Manbhum, *Camp.*! No doubt in all districts of Chota Nagpur and Santal Parganahs. Balasore Hills, *Blandford*! Puri (Barkuda), *C. & N.*; Angul, *Chattarjee*! Fr. July–Dec. It usually dries up in January.

18. ACTINIOPTERIS, *Link.*

A small tufted fern with suborbicular 2-chotomously flabellately divided fronds. Stipes inarticulate with one half-cylindric vascular bundle, not black or polished. Venation flabellate with a midrib to each main segment and very oblique sec. nerves. Sori linear on an intramarginal vein connecting the sec. nerve-endings; margin of the frond thin and simulating an indusium.

1. **A. radiata,** *Link.* Actiniopteris dichotoma, *Bedd.*

A very pretty little erect rather stiff fern resembling a miniature fan palm, 3–7″ high. Fronds 1–1·5″ diam. repeatedly 2-chotomously divided into linear segments with acutely toothed tips. Sori in a continuous line on the side margins, not on the toothed tips.

On dry hillsides, rare. Chota Nagpur (without locality), *Wood's List.* I have collected it at Nagpur but not in Chota Nagpur, nor can I find specimens from Chota Nagpur. Fr. Nov.

19. PTERIS, *L.*

Usually robust tufted ferns or sometimes fronds distant on a wide creeping rhizome. Stipes inarticulate, not polished black, with one vascular bundle throughout. Fronds sometimes simple but usually pinnate or pinnately-compound with the lowest pinna usually strongly developed below at base on the basiscopic side. Veins all free or (in section *Campteria*) the lowest veinlets uniting with those from the next costule and forming long arches along the costa. A slender submarginal vein also connects the nerve-endings in the fertile frond except sometimes in the sinuses and tips of the lobes. Sori linear situated on the above marginal vein and covered by the indusium-like margin of the frond. Spores orbicular tetrahedral.

I. Fronds tufted simply pinnate or lowest pinnæ furcate or 2-pinnate on the basiscopic side only. Indusium single :—
  A. All veins free, pinnæ not pinnatifid, narrow :—
    1. Fronds simply pinnate with the pinnæ many close undivided, upper linear . . . . . 1. *longifolia.*
    2. Fronds with the lowest, or sometimes 2–3 lower, pinnæ with an accessory pinna, upper pinnæ unbranched (rarely all pinnæ simple in *pellucida*) :—
      Frond 6–12″. Pinnæ up to ·7″ broad, sterile and sterile portions of fertile fronds acutely serrate . . . 2. *cretica.*
      Frond 12–18″, pinnæ often 1″ and more broad, margin entire or crenate . . . . . 3. *pellucida.*

B. Lowest vein from each costule, or at least some of them, anastomosing with that from the next costule. All pinnæ deeply pinnatifid :—
Veinlets reaching the margin, lobes entire . . . 4. *biaurita.*
Veinlets not reaching the margin, terminating in dots, margin of barren portions of frond or barren fronds crenate . . . . . *geminata*
II. Fronds not tufted, 2–4 pinnate with many pinnæ. Indusium (p. 1204). double, one introrse, the other extrorse . . . . 5. *aquilina.*

1. P. longifolia, *L.*

A densely tufted fern with tip of rhizome and base of stipes densely clothed with linear acuminate brown or yellow scales. Stipes very short (in my specimens), 6–12″ long according to *Beddome.* Frond simply pinnate, the rhachis somewhat scaly or hairy, clothed from base to tip with simple pinnæ about 10–30 each side, which increase in length from the base upwards and end in a terminal pinna longer than all the others, lowest pinnæ often ovate or oblong often mere auricles, upper linear, lower cordate truncate or auricled at the base, especially on the basiscopic side, uppermost 3–8″ long by ·2–·3″ broad. Sori in a continuous band down both sides of the fertile pinnæ, with a well-marked pale indusium, annuli golden yellow.

Old walls, Purneah ! *Prain* (*Beng. Pl.*) says "in all the provinces," but there is no specimen in the *Cal. Herb.* or Kew from any district within our area. Fr. Nov.-Dec.

2. P. cretica, *L.*

Stipes 6–12″ long, erect, naked, or with lanceolate scales near the base, straw-coloured. Fronds (exc. stipes) 6–12″ long, sub-2-pinnate, the lowest or lowest 2–3, rarely more, pairs of pinnæ having one accessory secondary pinna near its base. Pinnæ few. Primary pinnæ or primary lobes of the double pinnæ linear 3–8″ long by ·17–·7″ wide acute or obtuse, barren pinnæ usually wider than the fertile, and as well as the barren portions of the fertile frond closely sharply serrate. Veins forked and simple, often very close together, diverging at a wide angle from the costa. Sori in a continuous band on the margins except near the base and apex, indusium distinct.

Balasore Hills, *Blandford* ! A commonly cultivated fern. Fr. all the year.

3. P. pellucida, *Pr.*

A larger stouter plant than *P. cretica.* Stipes 1 ft. or more. Fronds 12–18″ long, simply pinnate or occasionally lowest forked, pinnæ usually in 3–6 sessile pairs, entire or serrate, upper slightly decurrent, lower often 8″ by 1″, surface glossy.

Singbhum ! Santal Parg., *Gamble* ! Fr. Dec.
Although of different appearance it is, as *Clarke* says, only a large *cretica* with pinnæ often 1″ broad and usually simple. *Baker* also says not satisfactorily distinguished from *cretica.* The young fronds are often digitate, the old barren ones sometimes superficially resemble *Nephrodium moulmeinense.*

4. P. biaurita, *L.* Syn. Campteria biaurita, *Bedd.*

A large handsome fern with fronds (including the stipes) 3–6 ft. long and up to 2–2·5 ft. broad, tufted on an erect caudex 6–12″ high, simply pinnate and pinnatifid except at the base, the lowest pinna

being bifurcate or with 2–3 descending secondary pinnæ. Pinnæ 8–14 prs. and a terminal one, all free, sessile or lowest petioled, deeply pinnatifid, longer 8–15″ long by 1·5–2·5″ wide, with close regular linear-oblong rounded segments gradually decreasing upwards and finally ending in a linear entire tail 1–3″ long. Secondary pinna of the lowest primary half to three-fourths as long as the primary and similar. Costules prominent, the lowest vein (rarely more) from each costule usually meeting the lowest from the next costule, and forming a low arch and giving off several veinlets towards the sinus. Occasionally the veins meet the sinus without meeting one another; other veinlets from the costules numerous, all bifurcate from their base and meeting the margin. Sori in a continuous line all round the segments, rarely interrupted at the tips or sinuses. Indusium prominent, double.

Near watercourses. Purneah! Frequent in the Saranda forests of Singbhum! Hazaribagh (on Parasnath)! Fr. Sept. May.

Caudex stout. Stipes 1·5–3 ft. long, slightly scaly at the base, naked and polished straw-coloured above. The costæ have a small subulate process at the base of each costule on the upper side, which occurs in all my specimens though it does not appear to have been noted by *Beddome* or *Clarke*.

P. geminata, *Wall.* Syn. Campteria Kleiniana, *Presl.*

This is entered as from Chota Nagpur in *Bengal Plants*, and its characters are given in the key above. The only specimen is a plant from Parasnath which is to my mind merely *P. biaurita*. In addition to key characters *Beddome* says *Campteria Kleiniana* has sub-membranous fronds with falcate oblong segments, sterile ones broadly crenated, and the sori or indusium never reach the bases or apices of the segments. He gives the locality as Western mountains of the Madras Presidency.

5. **P. aquilina,** *L.* Syn. Pteridium aquilinum, *Kuhn*; Bracken.

A stout fern 2–6 ft. high with stout creeping rhizome and scattered fronds. Stipes 6–15″ long, yellowish green except at the dark-coloured base, without scales, slightly pubescent when young. Frond deltoid to triangular, lanceolate in outline, 1–2 ft. wide, 2-pinnate or 3–4-pinnate below, pinnatifid at the tip, hairy beneath and on the costæ above, coriaceous. Pinnæ numerous with many pinnules. Ultimate pinnules or lobes ·3–·6″ long (rarely more in our area) at base of the secondary or tertiary pinnæ, lanceolate or linear-lanceolate, sometimes falcate, veins close raised beneath, often twice forked. Indusium double, an inner extrorse and an outer firmer introrse.

On the highest mountains of the province (but not found on Parasnath). Neterhat Plateau, 3000 ft. and above! Mayurbhanj Mnts. 3500 ft. (Meghasani)! Fr. Dec.

Our plant has the pinnæ rather crowded and very hairy beneath. The genus *Pteridium* is perhaps rightly separated off from *Pteris*, but the name *Pteris aquilina* is one of the best known among ferns. Moreover the inner very thin indusium is said not to be always present; its edge is long-ciliate. In Campteria there appears to be a double indusium, but both are *outside* the receptacle and the outermost is continuous with the frond.

The habit of *P. aquilina* with its scattered fronds and many and much-divided pinnæ is quite different from our other species of *Pteris*.

20. DRYMOGLOSSUM, *Presl.*

Small epiphytic ferns with slender widely creeping rhizome. Fronds articulate with the rhizome, simple, dimorphic, the sterile short and

broad, the fertile linear. Venation obscure, pinnately anastomosing, forming 3–4 series of areoles between costa and margin including simple or forked free veinlets with clavate apices. Sori linear, confluent, scarcely immersed, more or less mixed with scales or stellate hairs, parallel to the costa or margin, sometimes at length covering the whole undersurface of the frond.

1. D. piloselloides, *Presl.*

A pretty little epiphyte with the filiform rhizome clothed with appressed narrow-rhomboid peltate laciniate scales. Barren fronds broadly ellipsoid, ·7–1″ long only, rounded both ends or base obtuse, young with stellate hairs; stipes ·1″ long only. Fertile frond linear with tapering base, 1·5–3″ long by about ·2–·25″ broad, tapering into a short slender stipes. Sori finally covering the whole undersurface except at base, mixed with stellate hairs.

On trees overhanging perennial streams in dense evergreen forest in the Duars! I have observed similar epiphytes in like places in Purneah and the Mals of Puri, but without fertile fronds. Fr. Jan.–Feb.

21. PLEOPELTIS, *Humb. & Bonp.*

Very often epiphytic with usually creeping rhizome. Stipes scattered or more rarely tufted, articulate on the rhizome. Fronds simple or more rarely divided, pinnæ when divided sometimes dimorphic. Veins often clavate at the ends, copiously anastomosing, forming irregular areoles with generally free included veinlets. Sori naked, usually round, sometimes oblong, generally on the back of united veinlets.

This genus is included in *Polypodium* by many botanists; *Polypodium* then would also include the genus *Goniophlebium*.

A. Fronds linear, more or less opaque, scattered:—
Fonds 3–10″, nervation invisible . . . . . 1. *linearis.*
Fronds 12–18″, nervation visible . . . . . 2. *simplex.*
B. Fronds lanceolate or oblong acuminate with winged stipes or subsessile, membranous, venation distinct . . . 3. *membranacea.*
C. Fronds lanceolate acute or obtuse, fleshy-coriaceous when fresh, venation visible but weak when dry . . . 4. *punctata.*

1. P. linearis, *Bedd.* Syn. Polypodium lineare, *Thunb.*

A small epiphyte with creeping slender woody rhizome closely covered with lanceolate scales with thick-walled cells. Fronds scattered, linear, undivided, 3–10″ long, very coriaceous so that the nervation is invisible when dry, base gradually narrowed into a stipes of indefinite length, but usually under 1″, both sides glabrous when old, thinly hairy or scaly when young. Sori large orbicular or ellipsoid, in a single row half-way between margin and midrib, not sunk. Capsule pale with a red annulus and beautiful golden spores.

Closely adhering to rocks, often among mosses and hepaticæ. Ranchi, at Neterhat, 3000 ft.! Fr. April–June.
Tip of frond often twisted in the hot season. Nerves closely reticulate with forked free veinlets in the areoles. Young sori with copious thin peltate scales.

2. **P. simplex,** *Bedd.* Syn. Polypodium simplex, *Sw.*

With regard to this fern *Beddome* states that it is very like *P. lineare* only the fronds are of thinner texture and much larger, up to 2 ft. long by 1–2″ broad, the veins more distinct, the sori always more or less deeply sunk and forming pustules on the upper side of the fronds, sometimes quite sunk in a cyst with visible margins.

A specimen from Parasnath called *P. simplex* in the *Cal. Herb.* (apparently the one from Chota Nagpur in *Beng. Pl.*) appears to be *P. lineare*, but the two are united by *Hooker & Clarke* according to *Beddome*. *Clarke* does not mention *simplex* in his *Ferns of Northern India*, though from his description of *lineare* he includes it. According to *Christensen*, *P. simplex* = *Polypodium excavatum*, *Bory*, and is var. *β* of *Polypodium lineare* in *Hooker & Baker's* ferns, *i. e.* the larger variety with fronds sometimes 18″–2 ft. long and 2″ broad, texture thinner and veins more distinct. In our *P. lineare* the venation is very obscure.

3. **P. membranacea,** *Bedd.* Syn. Polypodium membranaceum, *Don.*

Rhizome short-creeping, the younger portion densely covered with dark grey lanceolate or ovate acuminate scales. Fronds scattered or almost tufted, subsessile or with a winged stipes gradually passing into base of the frond, the latter lanceolate or oblong, 6″ to 15″ (in our area, sometimes much larger in the Central Provinces hills, etc.), acuminate, rather suddenly narrowed at base, membranous with the numerous subparallel veins or costules distinct, spreading at a wide angle from the costa and nearly reaching margin, which is entire, undulate or sinuate; veins between the costules very reticulate and the areoles including many free venules. Sori ·06–·07″ diam. only, rather scattered on the anastomosis.

Singbhum, Saranda forests above 1000 ft. on trees in ravines! Hazaribagh on Parasnath! Fr. Sept. Dries up in c.s.

4. **P. punctata,** *Bedd.* Syn. Acrostichum punctatum, *L.*; Polypodium irioides, *Hook.*

A Hart's-tongue-like fern with scarcely creeping rhizome with brownish ovate or lanc. scales. Fronds 9″–3 ft. long and 1–3″ broad, base gradually tapering to a very short stipes, apex acute or obtuse, texture somewhat fleshy-coriaceous with the venation immersed when fresh, visible when dry, weak with numerous branched free veinlets in the areoles which have clavate apices. Sori compital, very small or m.s. and up to ·05″ diam., often confined to the upper half of the frond.

Purneah, *J. D. H. & T. T.*! Balasore Hills, *Blandford*! Very common on trees near Calcutta and probably in the adjacent parts of Orissa. Fr. May.

22. NIPHOBOLUS, *Kaulf.*

Usually rather small and mostly epiphytic ferns with widely creeping rarely short rhizome. Fronds simple entire, very rarely lobed, densely matted beneath with a thick stellate tomentum. Veins often obscured by the tomentum, pinnate from the costa with copiously anastomosing veinlets with frequently free included veinlets in the areoles; fertile fronds often contracted and venation less developed. Sori numerous, globose or elliptic, more or less immersed in the tomentum.

Fronds mostly dimorphous, fertile, longer under 9″, sporangia mixed with stalked stellate scales. Costules very obscure . 1. *adnascens.*
Fronds uniform, mostly over 9″, sori not mixed with scales. Costules distinct . . . . . 2. *stigmosus.*

1. **N. adnascens,** *Kaulf.* Syn. Polypodium adnascens, *Sw.*

A small fern with extensively creeping slender rhizome densely covered with imbricating narrow linear light-brown scales. Fronds scattered dimorphic, fleshy-coriaceous, covered beneath with a dense stellate silvery tomentum, upper surface with thinner tomentum or glabrous, green, obscurely showing the close oblique primary venation; barren fronds 1–3″ only, oblanceolate or spathulate obtuse tapering into a short slender stipes. Fertile fronds up to 6″ by ·7″ lanceolate or linear-lanceolate tapering into a slender stipes 1–1·5″ long. Sori usually on the upper half of the frond only, dense, mixed with long-stalked stellate scales.

Closely clinging to the surface of mossy rocks and trees. Monghyr (near Jamalpur), *Cal. Herb.*! Ravines in Singbhum! Hazaribagh, on Parasnath, *Prain*! Angul! Fr. Sept.–March (probably all the year round).

Beddome says fertile fronds 6–8″ long, costa subcarinate, costules sunk obscure, their areoles including 2–4 free veinlets with clavate apices, though they sometimes anastomose, sori deep sunk, arranged 5–6 in obliquely transverse series. Some Angul specimens have all linear fronds and none of the shorter form.

2. **N. stigmosus,** *Bedd.* Syn. Polypodium stigmosum, *Sw.*

Rootstock short or wide-creeping, stout, clothed especially round the base of stipes with very slender linear scales. Fronds sub-clustered 6–18″ long (1·5–2 ft. in districts outside our area) by ·7–1·7″ wide, linear-lanceolate tapering both ends and decurrent on the short stipes, densely stellate tomentose beneath but distinctly showing the numerous parallel oblique costules. Sori very numerous and small occupying the whole space between the costules and immersed in the tomentum.

On trees. Parasnath, *Clarke*! Mayurbhanj Mnts. above 2500 ft.! Fr. May–Sept.

Clarke says the tomentum is reddish-brown; in my specimens the dense sori gave a reddish-brown appearance to the fertile fronds beneath but the tomentum was grey.

23. DRYNARIA, *Bory.*

Epiphytic ferns with the fronds articulate to the caudex or rhizome and very dimorphic. Barren fronds broad-oval sessile with cordate base, concave or spoon-shaped, strongly nerved, poor in chlorophyll and their mesophyll soon dying. The normal or fertile fronds are stipitate and altogether resemble those of the *Pleopeltis* section of *polypodium, i.e.* the veins are copiously anastomosing forming quadrate or hexagonal areoles. Sori round or oval, small, numerous.

The barren fronds collect a great deal of humus in which adventitious roots from the plant find nutriment.

1. **D. quercifolia,** *Bory.* Polypodium quercifolia, *L.*; Garur, *Beng.*; Garur-panki, *Or.*

Rhizome creeping, short, with lanceolate-subulate cordate-based scales ·2–·5″ long. Sterile fronds 3–12″ by 7–8″, glossy, pinnatifid

or lobed, soon turning brown. Fertile 2–3 ft. long, pinnatipartite with oblong acuminate entire segments 5–9″ by 1–1·5″, costules distinct, veins very reticulate, sori on the anastomosis, small, in two series between and parallel to the costules.

On the branches of trees. Singbhum! Sambalpur, *Griff.*! Puri!

24. GYMNOPTERIS, *Bernh.*

Rhizome usually creeping and sometimes epiphytic. Stipes not articulate on rhizome. Frond simple or simply pinnate, often dimorphic; fertile fronds usually much contracted, if similar to the barren then often with the sori on a contracted apex. Veins copiously anastomosing with free veinlets in the areoles. Sori usually completely hiding the surface of the fertile frond and coalescent. Indusium 0.

The occasional presence of fronds similar to the barren ones but dotted all over with large distinct sori render the position of this genus, assigned to it by *Diels*, near to *Aspidium* very probable. It is distinguished from the *Polypodium*-series by the stipes not being articulate.

Fronds all simple . . . . . 1. *variabilis*.
Fronds all pinnate . . . . . 2. *costata*.

1. **G. variabilis,** *Hook.* Syn. G. axillare, *Cav.*

A very variable fern in the size of the fronds, always with a slender creeping rhizome of variable length, with blackish lanceolate acuminate scales.* Fronds in some forms reminding one of the *Hart's-tongue* fern, sometimes very small, always simple. Barren fronds 5″ by ·7″ to 15″ by 1·5″, linear-lanceolate to oblong, rarely broadly lanceolate or ovate-lanceolate and up to 2″ wide, base tapering into the 1–5″-long stipes which has sometimes a few scales near base. Veins usually raised and distinct, soon branched and forming many rectangular areoles with free included veinlets, of which the apices are marked by a pit on the upper surface, very rarely with scattered large sori below. Fertile fronds very narrowly linear (under ·1″ wide) with narrow incurved margins and the sori covering the whole under-surface.

Grows on rocks in shady nalas or sometimes creeping up trees. Singbhum, frequent! Ranchi 2–3000 ft.! Fr Jan.–March.

Var. **axillaris,** *Bedd.* Syn. G. axillare, *Cav.*

This is a form with slender tortuous elongate nearly naked rhizome which ascends trees and is said also to differ by the more diaphanous fronds.

2. **G. costata,** *Bedd.* Syn. Meniscium deltigerum, *Hook.*; Acrostichum costatum, *Wall.*

Rhizome creeping, with subulate scales. Stipes up to 1·5 ft. long, fronds up to 2 ft. or more, pinnate, pinnæ up to 14″ by 3″, petioluled, acuminate with entire sinuate or crenate margin, veins very prominent and generally much raised, close together, areoles numerous, costal ones small or obsolete, empty, several excurrent veinlets from all the other areoles which are irregular, free or anastomosing.

Mahuagarh, Santal Parganahs, *Gamble* (the specimen however not examined by me)! The description of the species from *Beddome*.

* The scales are hyaline, but with very black cell-walls.

25. STENOCHLÆNA, *J. Sm.*

Rhizome stout or slender, scandent. Fronds simply pinnate with the pinnæ articulate on the rhachis, fertile contracted and very narrow, veins as in *Blechnum* simple or forked, fine close and parallel, generally quite free to the margin and there entering a marginal vein, rarely some forking and the two forks again uniting, or more rarely two separate veins unite. Sori very many and spreading on to the parenchyma between the nerves, finally covering the whole underside of the frond except the costa and the often somewhat modified inrolled margin.

1. S. palustris, *Mett.* Syn. Acrostichum scandens, *J. Sm.*

A very tall scandent fern with large pinnate fronds 3–5 ft. long, the leaflets of which resemble those of the leaves of an *Oleandra*. Stipes not articulate, about 2 ft. long, pale brown, without scales. Lflts. about 20 each side alternate except at the top, mostly subequal, uppermost smallest, barren oblong or oblong lanceolate, acuminate, larger 7–9″ long by 1·7–2″ wide, base cuneate with short petiolule articulate on the smooth yellow-brown rhachis, costa prominent with few pale irregular scales and with very close numerous spreading fine parallel simple nerves free to the margin where they unite in a marginal nerve; rarely a few nerves bifurcate and then again often uniting; marginal nerve stout with distant appressed spinulose teeth.

On tree-trunks in wet evergreen forest. Mals of Orissa! Monghyr, Ham.!
Rhizome rather slender, up to ·3″ diam., with tufts of roots and few pale small irregular scales, concolorous with the stipes. On either side of the costa of the barren pinnæ (and perhaps also in the fertile ?) and close to it is a thick raised nerve (or slender ridge or wing according to *Beddome*), which appears to correspond with the similarly placed but slender nerve in *Blechnum*. A gland occurs near the base of the pinnæ on the acroscopic margin.

26. ACROSTICHUM, *L.*

Large ferns with stipes inarticulate on the stout erect rhizome. Fronds pinnate all similar and pinnæ similar to one another, distinct with strong costa, costules or principal veins not well marked but all veins very reticulate, forming numerous subquadrangular areoles without free included veinlets. Sori densely covering the whole under-surface of the fertile pinnæ except sometimes towards the base and the costa. Indusium 0.

1. A. aureum, *L.*

A tall handsome very tough fern 3–6 ft. high with erect pinnate coriaceous fronds tufted on an erect caudex. Stipes 1–2 ft. glossy. Pinnæ suberect lower 6–10″ long by ·7–1″ broad, linear-oblong, base shortly cuneate, tip rounded, the uppermost pinnæ fertile and a ruddy brown, venation very fine.

In the swamps of the Cuttack delta! Fr. April–June.

FAM. 3. PARKERIACEÆ.

Marsh or water ferns rooting in mud with simple, simply pinnate older often submersed leaves and pinnately divided aerial fertile leaves with narrower segments, venation mostly longitudinal, distantly anastomosing. Sporangia scattered dorsally on the veins, not united into sori, subsessile with a vertical annulus which is either complete, partial or obsolete. Indusium 0, but margin of frond recurved and meeting near the costa. Prothallia dicœcious. Female with central axis of several layers of cells. Male smaller thinner and sub-spathulate with numerous antheridia on the margin.

1. CERATOPTERIS, *Brong.*

(The only genus.)

1. **C. thalictroides,** *Brong.*

A succulent tufted fern 6–15″ high, the stipes with large air-cells. Barren fronds floating or erect, simple or slightly divided when young or 2–3 pinnatifid with broad oblong segments. Fertile arising later, 2–3-pinnate with linear succulent subtubular (from the recurved margins) segments.

Swamps, rice-fields, etc. Common in Chota Nagpur! Sambalpur, *Griff.*! probably in all districts. Fr. c.s. Usually annual, but *Beddome* says if kept moist perennial.

It is sometimes cooked as a vegetable.

FAM. 4. GLEICHENIACEÆ.

Terrestrial ferns with usually unlimited growth and climbing, primary axis usually dichotomous, axes of higher orders attached pinnately, often proliferous from the axils of the forks, veins all free. Sori dorsal, terminal on or at the forks of the veins, small and consisting of few (2–8) sporangia. Sporangia sessile or very shortly stalked, with a transverse or oblique* annulus a little above the middle and dehiscence vertical. Spores radial or bilateral.

1. GLEICHENIA, *Sm.*

Rhizome widely creeping, fronds scattered, dichotomously branched, rarely simply pinnate.

1. **G. linearis,** *Bedd.* Syn. G. dichotoma, *Willd.*

A very handsome fern, widely spreading and sub-scandent with repeatedly dichotomous branches, the lateral of limited growth, the main axes of unlimited growth. Innovations densely covered with ferruginous or golden hairs. Fronds coriaceous, glaucous beneath. Pinnæ in divaricate pairs at the forks, the lower pairs short 2–4″, the ultimate pairs sub-erect 6–10″ long, pinnatifid or cut to the

* The annulus of *Gleichenia* is always described as equatorial or transverse and sub-equatorial, but it is sometimes (in the same plant) very nearly vertical and may touch the short obpyramidal pedicel on one side.

rhachis with broadly-linear lobes; median lobes ·6–1·5″ long, apex of lobes emarginate (in our specimens, "usually entire," *Beddome*). Veinlets usually three branched from the base, the centre one being again forked or pinnate. Sori under ·05″ diam., usually one only on the acroscopic branch of each veinlet, sometimes also one on another branch.

Not very common, but where it does occur sub-gregarious in large patches, usually in open forest on hill slopes of white clay-schists and in the vicinity of a stream. Purneah, in the plains, on river banks! also on the Nepal boundary! Singbhum, 1000 ft.! Mayurbhanj, 2500 ft.!

FAM. 5. SCHIZÆACEÆ.

Ferns of various habit (scandent in our species). Stipes with one collateral, concentric or almost radial bundle. Fertile segments almost always modified by the addition of small fertile lobes or different from the barren segments of the frond. Sporangia not combined into sori (although they may be very close, they are not on a common receptacle), 1-locular, dehiscing vertically, annulus a small close ring of special cells situated near the top (not encircling the sporangium). Spores numerous. Indusia 0 or sometimes represented by a bract-like outgrowth of the frond or by its recurved margin.

1. LYGODIUM, *Sw.*

Scandent ferns climbing by means of their twining rhachis, with a creeping rhizome and 1-seriate fronds, the older with a twining rhachis of unlimited growth. Primary pinnæ abbreviated and ending in a bud-like tip, with one pair of divaricate secondary pinnæ which are either dichotomous or pinnate or merely lobed. Sporangia spicately 2-seriate and dorsal on specially developed lobes of the fertile pinnules, one sporangium on each vein embraced by a bract-like indusium, the several indusia imbricate. Annulus very small, coronate.

A. Pinnules linear-oblong (palmate in young plants), margins acutely serrulate:—
Some or most of the fertile pinnules 4–6″ long by ·4–·6″ wide in middle (without the soriferous lobes). Soriferous lobes mostly close in a straight line rarely borne on lobules of the pinnule . . . . . 1. *flexuosum*.
Fertile pinnules always under 3″ long, mostly under ·4″ wide, usually forming an uneven line on lobules of the pinnule 2. *japonicum*.
B. Pinnules mostly lanceolate with cordate base in barren, mostly broadly ovate in fertile pinnæ, rarely 1″ long, margins minutely crenulate . . . . . 3. *microphyllum*.

1. L. flexuosum, *Sw.* Syn. L. pinnatifidum, Sw.

A graceful climbing fern. Primary pinnæ abbreviated to a small knob with hairy apex and bearing a pair of 1–2-pinnate divaricate secondary pinnæ on well-grown fronds (pedately dichotomous on young fronds) 6–18″ long. Ultimate pinnules shortly stalked, linear-oblong with or without a cordate or 2-lobed base, barren attaining 6–7″ long by ·7–1″ wide in the middle, serrulate, with many

parallel forked veins, of which one veinlet enters each tooth, fertile rather narrower (excluding the sporangial lobes), pectinately lobed with the sporangial spikes which are ·15–·25″ long.

Very common in the forests. Champaran! Bhagalpur, *Cal. Herb.*! Purneah! Santal Parg.! Monghyr, *Cal. Herb.*! All districts of Chota Nagpur! Angul! Doubtless, therefore, throughout the whole province. Fr. Aug.–Dec. The fronds are annual.

The leaves and rhachides are often sparsely hairy beneath.

2. **L. japonicum,** *Sw.*

A small form in which the secondary (divaricate) pinnæ are not more than 6″ long in the mature plant, the pinnules never exceed 2″ in length or the terminal 2·5″ and the sporangial spikes stand on distinct lobes of the pinna; which is usually much more deeply lobed than in *flexuosum*.

Purneah, frequent!

This plant, although it at once strikes one as distinct in the field, is probably only a variety of *flexuosum* and is difficult to define. The fertile segments are often more finely cut and frequently hairy beneath, and sometimes each pinna is 3-pinnate and also pinnatifid—a very pretty form. In some Chinese specimens the barren portion of the lamina is almost absent.

3. **L. microphyllum,** *R. Br.*

A very graceful fern with twining fronds as in the last but more delicate. Main pinna ending in a tuft of golden hairs, lateral pinnæ 3–6″ with a delicate zigzag rhachis, simply pinnate only and with more slender stalks to the pinnules. Pinnules broadly ovate to lanceolate-ovate, sometimes as broad as long, barren ones not exceeding 1″ or terminal 1·5″ and bifurcate, margin minutely crenulate, texture membranous, fertile orbicular or ovate ·5–·7″ long. Stalks of pinnules ·1–·2″, very slender.

Often festooning bushes and other creepers near the sides of streams in Purneah! Fr. Nov.–Dec.

FAM. 6. MARATTIACEÆ.

Usually very large ferns with erect rhizome or short stem, rarely with creeping rhizome. Leaves circinate in bud and covered when very young by the well-developed *stipules*, pinnately compound (rarely entire or palmate outside our area), stipes or base of pinnæ with a swollen articulation. Sori dorsal on a round or elongate receptacle, usually on the more or less parallel free veins but sometimes veins copiously anastomosing and sori on the anastomosis, either of more or less free 2-ranked sporangia or united into a chambered "synangium." Synangium hollow in the middle or opening by 2 valves, or by pores to each chamber. Sporangia if free opening introrsely by a slit. Indusium 0 or slight.

The *Marattiaceæ* have several peculiar anatomical characters different from true ferns. Moreover the sporangia proceed from a group of cells, and the archesporium (cell from which the spores collectively develop) is the hypodermal terminal cell of an axile row of the rudimentary sporangium (*Eusporangiate*). In the true ferns (also in *Salviniaceæ* and *Marsiliaceæ*, *Leptosporangiate Filicineæ*) the sporangia are formed from a single epidermal cell and have a peculiarly shaped, usually tetrahedral archesporium. These characters are considered of so great importance

by morphologists that the *Hydropterideæ* (including the *Salviniaceæ* and *Marsiliaceæ*) are usually placed next to the true ferns, while the *Marattiaceæ* and *Ophioglossaceæ* are placed subsequently.

1. ANGIOPTERIS, *Hoffm.*

Fronds very large 2-pinnate. Sporangia contiguous and angled by pressure but not united into a chambered synangium, in two parallel rows forming an ellipsoid oblong sorus. Veins simple or forked free.

1. **A. evecta,** *Hoffm.*

A magnificent fern, with a very stout short erect caudex or short thick stem sometimes 2 ft. high and huge 2-pinnate fronds 6–10 ft. long (in our area; attaining 20 ft. in hotter damper localities). Pinnæ 1–3 ft. long with swollen bases, pinnules subcoriaceous, glabrous shining, linear, ·3–1″ wide, crenulate, veins close parallel. Sori at the ends of the veins ·04–·06″ long of about 7–12 sporangia somewhat laterally compressed by one another and opening by a vertical chink.

Deep valleys along streams in Singbhum! One would expect to find this also in the mals of Orissa, but I do not recollect having seen it there. Fr. March–May.

Easily recognized by the large stipules at the base of the swollen articulate stipes.

FAM. 7. OPHIOGLOSSACEÆ.

Usually small perennial ferns with short sometimes tuberous, erect rarely creeping rhizomes. Fronds not circinate in vernation, sheathing, exstipulate. Barren fronds or their barren segments simple linear to broad and cordate, or sometimes palmate or repeatedly dichotomous or pinnately compound. Fertile segments usually similarly divided to the sterile part of the frond but much contracted and modified, usually above the sterile segments (rarely small fertile spiciform leaf-segments arise from the base of the spreading part, but not in our area). Sporangia confined to the side nerves of the fertile segments, sunk in the tissue or free, spherical, opening transversely or longitudinally without an annulus. They are formed from a group of superficial cells and have a several-layered wall. Archesporium the hypodermal terminal cell of the axile row of the young sporangium. Spores all similar, orbicular-tetrahedral. Prothallus (as far as known) long-lived, monœcious, subterranean and tuberous.

A. Sporangia opening transversely :—
  1. Sporangia 2-ranked on the lateral nerves of a slender spiciform fertile leaf-segment and sunk in its tissue. Sterile leaf-segment usually simple and entire, reticulately veined . . . . . 1. *Ophioglossum.*
  2. Sporangia on the margins of the usually pinnately divided fertile segment, 2-ranked on each segment, globose and not sunk in the tissue. Veins not reticulate 2. *Botrychium.*

B. Sporangia with vertical dehiscence :
  Sporangia in small clusters on short simple or branched rhachides which arise on all sides of the fertile segment. Sterile part of the frond palmately pinnate with curved dichotomously branched free sub-parallel veins . . . . . 3. *Helminthostachys.*

1. OPHIOGLOSSUM, *L.* Adder's Tongue.

Small terrestrial ferns or larger and epiphytic. Terrestrial forms with a simple undivided linear to broadly cordate barren segment of the single frond, epiphytic forms with a dichotomously divided or palmately lobed barren segment. Sporangia situated laterally in two rows on the edges of a very narrow linear spike-like stalked spiciform segment of the frond, in the lamina of which they are sunk and open by a transverse fissure reaching the axis of the spike (sporangiophore). The sporangiophore arises at the base of the barren lamina (in our species) and is erect, or it may arise on the lamina above the base, or even there may be several sporangiophores from the stipes and lower part of the lamina (not in our area). Venation reticulate.

A. Barren part of frond usually over 2″ placed half-way up or more :
  Barren segment of frond broadly ovate cordate, with a short stalk above junction with fertile portion, membranous . 1. *reticulatum.*
  Fronds with barren segment 2–4″ ovate or ovate-oblong not stipitate or cordate, somewhat coriaceous. Spike stout with short peduncle . . . . . *vulgatum* (pp. 1214, 1215.)
B. Frond with barren segment 2″ or less, placed near base, not stipitate. Peduncle and spike very slender . . . 2. *nudicaule.*

1. O. reticulatum, *L.* Syn. O. vulgatum according to D'Almeida.

Whole plant 6–12″ high with a short narrow erect rootstock. Sterile frond sub-coriaceous when fresh, membranous when dry, ovate or broadly ovate, 1·5–3″ by 1·1–2·5″, cordate and the base below the sinus produced into an obcuneate often sheathing stalk (of same texture as frond) up to ·5″ long to the junction of the fertile segment; point of branching of the two segments one-third to less than half whole height of plant from the ground. Sporangial spike 1–2″ on a slender stalk. Venation of barren segment reticulate with a more or less distinct central vein but no midrib.

Under dense shade. Ranchi (Ichadagh), 2500 ft.! Hazaribagh (Parasnath), 3500 ft.! Fr. Aug.–Dec.

Prof. J. F. D'Almeida (*Journal of Indian Botany*, December, 1922) gives reasons for uniting *O. reticulatum* with *O. vulgatum*, L. Compared with my English specimens of *O. vulgatum* the two appear to be very distinct, but apparently numerous intermediate forms occur.

2. O. nudicaule, *L.* Syn. O parvifolium, *Hook. & Grev.*

A very small fern only 1–4″ high with a short erect somewhat tuberous rootstock and frequently 2–3 fronds. Barren segment of frond placed one-third the way up or from quite near the base, linear lanceolate or ovate, acute or subobtuse, sessile and tapering at the base, ·5–2″ long (·5–1″ long only, *Bedd.*) by ·25–·6″ wide, texture rather thin, venation mostly reticulate with hexagonal areoles but not very distinct. Sporangial spike ·4–·7″ long, slender (only ·07″ or less wide), and on a long slender peduncle greatly exceeding the barren segment.

Manbhum, *Campbell!*

This is called *O. vulgatum* in the *Cal. Herb.* and appears to have been accepted

as such by *Prof. D'Almeida* (*loc. cit.*), but agrees better with the species called *nudicaule* in the *Kew Herb.* which is *Baker's nudicaule*. It differs from *O. vulgatum* in the very long slender peduncle, much longer than the stem below the frond, in the thinner texture of the frond, more slender spike and more tuberous rootstock, but possibly it is not distinct.

2. BOTRYCHIUM, *Sw.*

Erect terrestrial ferns with small tuberous rootstock, fronds 2-forked with the barren portion of the frond foliaceous, usually primarily 2-chotomously divided and 2–3-pinnatifidly compound, rarely simply pinnate, venation flabellate free. Fertile fork of frond stipitate from the base of the barren portion, consisting of a panicle-like soriferous receptacle branched similarly to the barren but without obvious lamina, covered on the segments with small globose coriaceous capsules or sporangia which dehisce transversely.

1. B. daucifolium, *Wall.*

A handsome plant 1·5–2 ft. high. Barren half of frond deltoid about 1 ft. diam.; primary divisions of blade 2-chotomous or main rhachis straight and then appearing as primary pinnæ; primary segments or pinnæ pinnate and pinnatifid below, pinnatifid above (in our plant, sometimes 2-pinnate), lower pinnæ much the largest; ultimate segments oblong crenate-serrulate (in our plant; sometimes lanceolate-oblong and "finely toothed," *Beddome*). Panicle 3–4·5 long, 3-pinnate, on a stipes 6″ long and exceeding the barren part of the frond.

In evergreen forest close to our area (Jalpaguri district)! Fr. Nov.–Dec.

3. HELMINTHOSTACHYS, *Kaulf.*

Fertile frond bifurcate, with a barren foliaceous portion and a sporiferous panicle. Barren portion primarily 3-chotomous or with one pair of pinnæ, each division pinnately subdigitately or pedately divided, veins forked from a central costa with free parallel branches. Fertile portion a stipitate distichous spiciform panicle, consisting of numerous close verticillate pedicellate tufts of sporangia terminated by a crest-like appendage. Sporangia fleshy-coriaceous sessile, globose, inverse, bursting extrorsely and longitudinally from the base upwards, valves hemispherical.

1. H. zeylanica, *Hk.*

Plant about 12–18″ high, looking superficially like an aroid (without the panicle). Rhizome thick fleshy creeping. Stipes 7–12″. Barren fork of frond 4–6″ diam., primarily 3-partite, with the segments sessile or shortly stalked and again forked or pinnatifid, ultimate segments oblong or linear-oblong 2·5–4″ long by ·5–1″ wide, acute obtuse or acuminate, denticulate or serrulate, nerves numerous close parallel forked. Fertile part of frond ·25–·3″ diam., shorter than or exceeding the barren, its peduncle about as long as the dense spiciform portion or spike sometimes 5″ with peduncle only 3″. Sporangia globose ·04–·05″ diam.

Among moist bamboo clumps, Bengal, *Wall.*! Bihar, *Beng. Pl.*, but I can find no specimens from Bihar. Fr. Aug.

Order HYDROPTERIDEÆ. *Water-ferns.*

FAM. 8. SALVINIACEÆ.

Small or delicate, mostly annual, aquatics floating on the surface of the water with a dorsiventral stem with two or more rows of leaves, sometimes verticillate, on the dorsal face, and modified filamentous root-like leaves or true roots on the ventral face. Leaves folded lengthwise in vernation. Sorus one in each unilocular thin-walled sporocarp or indusium, which is composed of two layers of cells. Spores of two kinds, macrospores and microspores, those in the sporocarp all of one kind, but macrosporangia and microsporangia in the same cluster on metamorphosed leaf-segments. Microspores giving rise to a rudimentary prothallus which emerges from the spore through a 3-cleft orifice and forming antheridia. Fem. prothallus well-developed, emerging and bearing several archegonia.

Leaves very small, 2-ranked, deeply 2-lobed. Roots present . . . 1. *Azolla.*
Leaves in numerous alternating 3-merous whorls, 2 aerial and one ventral root-like submerged in each whorl. Aerial leaves in 4, submerged in 2 alternating series on the stem. No true roots . . 2. *Salvinia*

1. AZOLLA, *Schreb.*

Small annual floating herbs with much dichotomously branched stems, closely covered with minute fleshy imbricating leaves. L. alternating in two series, deeply 2-lobed, lobes unequally developed, upper floating with a peculiar recess on its inner side which contains *Nostoc* filaments, lower lobes submerged. Roots solitary or in tufts. Sorus or sporocarp a 1-celled capsule, wall or indusium 2 cells thick, capsules 2 or 4 together on the lower lobe of the first leaf of a lateral shoot, containing either microsporangia or macrosporangia. Microsporangia on a stalk of 2 cell-rows radiating from a slender columella, containing numerous spores aggregated into "masulæ" covered by a hyaline cuticle. Macrosporangia with a single spore, the episporium variously developed and furnished with swimming-bladders.

1. **A. pinnata,** *R. Br.* Syn. Salvinia imbricata, *Roxb.*

A small pretty floating aquatic, usually reddish especially towards the end of the rainy season, with very small imbricate rhomboid obtuse upper leaf-lobes. Roots solitary. Sori paired. Masulæ without glochidia. Macrospores with 9 swimming-bladders.

Common in the r.s. and then disappearing! Probably in all districts.
The repeated dichotomous branching with the stronger branches alternately to right and left results in a more or less deltoid form to the whole plant which attains about 1–1·5″ diam. at the base. The upper leaf-lobes are sometimes somewhat oblong, obtuse, papillose; lower membranous, of but one layer of cells. The roots have a distinct membranous root cap.

2. SALVINIA, *L.*

Small floating aquatics. Leaves in numerous 3-merous alternating whorls consisting of two normal aerial dorsal leaves and the third ventral submerged root-like, forming on the stem 4 rows of aerial

leaves and two rows of submerged leaves. True roots absent. Aerial leaves with well-developed simple sessile or short-petioled lamina sometimes resting on the surface; submerged longer, without lamina, divided to the base into filiform segments. Sorus or sporocarp a 1-celled capsule, paired or clustered at the base of the submerged leaves, its wall formed of an indusium of 2 cell-layers as in *Azolla*. Microsporangium with numerous microspores, on a slender stalk of one row of cells radiating from a columella projecting into the cavity of the sporocarp, spores not grouped into "masulæ." In the female sporocarp are several short-stalked macrosporangia each with one macrospore, episporium developing a 3-rayed cleft through which the prothallium projects on germination.

L. horizontal oblong, not crowded . . . . . 1. *natans*.
L. more or less erect, folded and crowded . . . . . 2. *cucullata*.

1. S. natans, *Hoffm.*

A small floating plant with horizontally spreading oblong leaves ·3–·5″ long and about half as broad, rounded or slightly cordate at base, upper side with about 12–20 pinnately arranged rows of hairs or bristles in tufts, under-side thinly matted like the stem with shining pellucid brown hairs. Sporocarps 4–8 in a cluster with regularly hexagonal wall cells.

Backwaters in the warmer districts, frequent in Purneah! Santal Parg.! Probably in Orissa.

2. S. cucullata, *Roxb.*

A small tufted aquatic with sessile leaves broader than long, erect or suberect and very congested on the rhizome, margins incurved so that the leaf becomes funnel-shaped, ·5–·7″ wide, flabellately nerved, upper surface closely papillose, undersurface nearly naked. The sporocarps have not been seen.

Very abundant in the rainy season, often closely covering the surface of backwaters and carried down by the rivers. Purneah! Singbhum! Probably all districts.

FAM. 9. MARSILIACEÆ.

Creeping marsh plants, rarely floating, with a dorsiventral stem and erect subsolitary or 2-ranked leaves with a 4-partite blade of 4 obovate leaflets (setaceous and without blade in *Pilularia*, which does not occur in India), ventral side with a row of roots. Leaves circinate in vernation. Spores of two kinds, macrospores and microspores, contained in the same 2–more-celled coriaceous oblong or globose sporangium. Male prothallus enclosed in the spore until the development of the antherozoids. Fem. prothallus a few-celled tissue sometimes almost reduced to a single archegonium never separating from the spore.

In the *Salviniaceæ* the sporocarps appear to be a special development of the indusium. In the *Marsiliaceæ* the sporocarps are of much more complicated structure, sometimes exceedingly hard, several-celled and filled with parenchyma. It appears to be a metamorphosed segment of the leaf, and it is borne on the ventral side of the petiole of ordinary foliage leaves on a long stalk, which runs along the dorsal edge of the capsule and gives off lateral veins which branch dichotomously and run to the ventral edge.

1. MARSILIA, *L.*

Small herbs with a slender creeping rhizome terminating in a 3-sided apical cell giving rise to 2 dorsal rows of leaves and a ventral row of roots (adventitious roots are also sometimes developed). Mature leaves 4-foliolate; in very young plants there is a cotyledonary leaf followed by simple primordial leaves and sometimes floating leaves. Sporocarps bean-shaped, bilaterally symmetrical, many-celled, finally 2-valved, pedicelled. Pedicels branching from the petiole of the leaf or from its base, solitary, or several from one petiole (*cp. Ophioglossum*), adnate to the base of the sporocarp and forming a raphe (not always apparent) which usually ends in a tooth and often bears a second lower tooth; its vascular bundle running along the dorsal edge of the sporocarp gives off lateral nerves into both valves which fork and run to the opposite suture. Mature sporocarps with very firm shell consisting of 5 layers. Innermost a cartilaginous band passing round the sutures and from which spring opposite the nerve-forks on both sides the sori. On the valves opening in water this tissue swells up, becomes extruded, and finally rupturing one end, is seen to bear the sori pinnately arranged along it, each enclosed in a hyaline membrane. Each sporangium with few macrospores and many microspores.

So far as the herbarium material goes there appears to be but one species of *Marsilia* in our area. *M. quadrifoliata, L.*, certainly *does not* occur and probably does not occur anywhere south of the Himalayas. In the following key (from *Sadebeck*), however, I have given the character for some other Indian species which may possibly occur:

I. Several (2–5) sporocarps at the base of the petiole. L. without interstitial strips of sclerenchymatous cells :—	
A. Pedicels arising far from the base of the petiole, connate for about half their length	(*quadrifoliata*).
B. Pedicels arising at the base of the petiole, free or very shortly connate with one another :—	
1. Sporocarps strigosely hairy or glabrescent, often ribbed, usually margined. L. lobulate	1. *minuta* (*erosa*).
L. entire, larger, sporocarps usually 2, sometimes 1 .	var. *major*.
2. Sporocarps hirsute with erect hairs. Pedicels shorter than the sporocarps :—	
Sporocarp distinctly ribbed	*brachypus*.
Sporocarps not ribbed	*gracilenta*.
II. Sporocarps always solitary. L. with interstitial strips of sclerenchyma cells. Pedicels 2½–6 times as long as sporocarp	*coromandeliana*.

1. **M. minuta,** *L.* Syn. M. erosa, *Willd.* (including also M. quadrifoliata of Bengal Plants).

A slender very variable herb with a widely creeping much branched slender rhizome, the growing tip hairy. Leaves very variable in size, erose or entire, leaflets with many obliquely anastomosing nerves meeting in the marginal nerve and without bands of sclerenchymatous cells between, outer surface in vernation hirsute. Sporocarps ·1″ long or more usually ·12–·18″ long, ellipsoid, on pedicels as long to twice as long as themselves, somewhat compressed and often with a marginal ridge, strigosely hairy but glabrescent, nerves (not visible externally) running without anastomosis to the opposite suture. Sori

very numerous. Pedicels usually paired, sometimes more numerous, quite free from the petiole and nearly so from one another.

In wet places throughout the province. Fr. Nov.–Jan.

The following extreme forms occur, connected by many intermediates :

Var. *α.* **minuta** proper. Syn. M. erosa, *Willd.*

A very small form with leaflets sometimes only ·12–·2″ long and broad or up to ·35″, cuneately obovate on petioles 1–2″ long, margin irregularly coarsely toothed or lobulate. Capsules usually very numerous, several or in the same plant rarely solitary at the base of each petiole, pedicels half as long again to twice as long as the capsule, ascending. Capsule usually margined, sometimes also ribbed, upper tooth longer.

Common, Singbhum and other districts of Chota Nagpur !

Var. *β.* **major.** Syn. M. quadrifoliata (*Beng. Pl.* non *L.*).

A very robust form, leaflets 1″ long and broad, entire, on petioles 6–10″ long. Sporocarps usually paired at the base of the petioles and often absent, sometimes solitary ·12–·18″ long, rarely margined, not ribbed. Pedicels mostly decurved and ascending, ·2″ long.

Also common, usually in running water !

This closely resembles the African *M. diffusa*, *Lepr.* ! Should the pedicels be shorter than the capsules and the latter be furnished with erect instead of strigose hairs, it would be *M. gracilenta*, *A. Br.*

EQUISETALES.

FAM. 10. EQUISETACEÆ.

Stem symmetrical erect or scrambling from a perennial creeping rootstock, jointed, sulcate, hollow except at the septa and with air canals beneath the grooves. Leaves reduced to the teeth of a foliar sheath arising from one internode and embracing the next, the teeth corresponding with the ridges. Branches 0 or whorled, springing from inside the base of the foliar-sheath and alternating with the teeth. Sporangia 5–10 on the under-surface of the sporophylls, which correspond in position and origin to the leaves and become modified into the peltate scales of a terminal cone, either on the summit of ordinary or of special cone-bearing stems. Sporangia opening by a slit towards the stalk of the sporophyll. Spores of one kind, developed from a hypodermal archesporium as in the ferns, with several coats which split into spiral hygroscopic bands (elaters), the function of which appears to be to keep groups of spores (which develop functionally one-sexual prothalla) together. Prothallium well-developed, flat and pluricellular.

1. EQUISETUM, *L.* Horse-tail.

Characters of the family. Only one genus.

Scrambling or subscandent. Branches sparse, weak. Cones subsessile, rounded or apiculate . . . . . 1. *debile.*
Erect. Branches dense. Cones shortly peduncled, obtuse . . 2. *diffusum.*

1. E. debile, *Roxb.*

Stems lax scrambling and often attaining 10 ft. among bushes. Branches long slender few, often only 2–3 in a whorl. Internodes

1·5–4″ long. Leaf teeth ·07–·12″ long, subulate-acuminate, black with scarious margin, very variable in number from 8–9 to many more on luxuriant plants. Cone or spike ·3–·7″ long, sessile in the funnel-shaped tip of the branch until mature then very shortly stalked; tip rounded or apiculate. Peltate sporophylls orbicular or oblong about ·05″ diam. pale with a black centre. Sporangia oblong yellow.

Along shady streams. Singbhum, not uncommon! Manbhum, *Camp.*! Ranchi, ascending to 3000 ft. at Neterhat! Fr. Sept.-Oct.

2. **E. diffusum,** *Don.*

Erect, 1–2 ft. high and easily distinguished by above characters. Found in the Jalpaiguri district and possibly occurs in Purneah.

LYCOPODIALES.

FAM. 11. LYCOPODIACEÆ.

Stems usually rigid prostrate and creeping, more rarely erect, sometimes from a creeping rootstock or corm, roots usually arising singly along the creeping stems or in erect ones sometimes growing down through the fundamental tissue and emerging at a lower point in a tuft, branching mostly dichotomous. Leaves very numerous small simple with a simple vascular bundle or nerveless, closely clothing stems and branches, verticillate or spiral, more or less imbricate. Sporangia formed singly at the base of the leaves or of the more or less leaf-like scales of a terminal or axillary cone, usually transversely elongate and reniform, originating in a group of superficial cells, finally 2-valved. Spores of one kind with three radiating lines and opening by three valves.

Prothallium (where known) usually very well developed and exhibiting various types, sometimes tuberous. That of some tropical species (including *L. phlegmaria*) is exceedingly interesting. It is more or less ribband-shaped, irregularly monopodially branched with radiating tuberosities, living during the wet season as a saprophyte in the bark of trees and forming bulbils which persist over the dry season. The inner tissues abound in oil and starch and also harbour an endophytic fungus. The sexual organs are developed on short thick branchlets, archegonia and comparatively numerous antheridia on the same prothallium.

1. LYCOPODIUM, *L.* Club-moss.

Characters of the family. (There is only one other genus of the family native of Australia and New Zealand to which the above characters do not altogether apply. *Psilotum* is now included in a separate family and does not occur in our area.)

I. Epiphytic. Branching entirely 2-chotomous with few forks. Stems densely clothed with leaves to the base :—
  A. Sporophylls not forming a distinct flower or club, or if club evident (some *squarrosa*), then sporophylls closely resembling the leaves :—
    L. oblong obtuse. Sporophylls resembling them . . 1. *Hamiltonii.*
    L. lanceolate subulate. Sporophylls smaller . . . 2. *squarrosum.*
  B. Sporophylls forming distinct slender flowers in double pairs, usually 3–4″ long but only ·05″ diam. . . . 3. *phlegmaria.*
II. Terrestrial. Branching primarily monopodial. Sporophylls strongly differentiated from the leaves :—
  Flowers or clubs short and broad sporophylls toothed . 4. *cernuum.*

1. L. Hamiltonii, *Spring.*

A terrestrial or epiphytic, cæspitose, erect suberect or pendulous rigid club-moss 2–4″ high (in our area; sometimes attains 12″), 2–4-times dichotomously forked, ·4–1″ diam. with the spreading firm leaves. Leaves ·2–·3″ or sometimes even ·5″ long on lower part of stem, subcoriaceous flattened, oblong or elliptic-oblong obtuse or rounded at tip, dense, glossy, with distinct midrib, often wrinkled when dry. Sporophylls like the barren leaves, not forming a cone or club. Capsules ·04–·05″ diam.

Top of Parasnath, *J. D. H.*! Fr. May–Sept.

2. L. squarrosum, *Forst.*

A rigid epiphyte with roots at the basal end only, 2-chotomously branched with subequal branches, whole diameter (with the leaves) ·6–1″. Stems clothed to the base with leaves of which the lower are perpendicular to the stem, upper suberect. Barren leaves lanceolate-subulate, ·4–·6″ long, coriaceous, midrib visible beneath. Fertile leaves mostly smaller relatively broader at base and then rather suddenly contracted, sometimes forming a flower or cone 1″ long, at other times scarcely differentiated. Capsule broadly reniform, pale, ·05″ broad.

Mayurbhanj, Meghasani, elev. 3500 ft. on trees! Also Tarai and Duars and therefore probably Purneah. Fr. May–June.

The plant growing wild had scarcely differentiated cones; taken and cultivated in a verandah the cones became well-marked the following year. It might therefore be included in section *Selago* or *Subselago*.

Pendulous, 1–2 ft. long, 2–3-times forked only with long branches and branchlets often upcurved at the tips. Leaves crowded moderately firm, dark green with distinct midrib. Sporophylls usually much smaller than barren leaves erecto-patent ·17–·25″ long.

3. L. phlegmaria, *L.*

A pendulous epiphyte usually over 1 ft. long forked 3–4-times. Leaves lanceolate or ovate-lanceolate with rounded or subcordate base, often ternate, coriaceous, shining, spreading, lower ·4–·5″ long. Flowers or clubs sharply differentiated, mostly in double pairs at the ends of the branchlets, very slender, 3–4″ long and only ·04–·05″ diam., sporophylls ovate wrinkled scarcely exceeding the sporangia.

Nepal, Tarai and Duars close to our area! Fr. April.

4. L. cernuum, *L.*

A very pretty club-moss with stems at first erect like a minature tree, finally falling over and widely diffuse but rooting at base only and not creeping, base of stem unbranched and almost bare of leaves, branching primarily monopodial, only the lateral and younger branches distinctly dichotomous. Leaves setaceous, spreading and upcurved and somewhat decurrent on the branchlets, rather soft, ·1–·15″ long. Sporophylls forming a distinct flower or cone which is short, ·2″ long and ·06″ diam., clavate, cernuous at the ends of the branches. Sporophylls lanceolate from a rhomboid base, toothed, pale, or shortly strongly ciliate, acuminate, paler than the leaves, much exceeding the small pale unequally valved sporocarp which is ·015″ long.

On river banks, sometimes sub-gregarious. Neterhat, 2-3000 ft. Fr. May-June.
Old plants extend several feet.

FAM. 12. SELAGINELLACEÆ.

(Excluding Isoeteæ.)

Erect or more often prostrate herbs with copious sub-monopodial or dichotomous branching in one plane. Leaves very small simple entire with a single vascular bundle, usually terminating in a point or delicate awn, very often ventral leaves larger and distichous (appearing lateral) and dorsal leaves smaller and unilateral, more rarely uniform and imbricate all round the stem, upper side with a minute or microscopic ligule. Sporophylls forming a quadrangular terminal spike or flower, usually similar to one another but often differing in shape to the sterile leaves. Sporangia arising between the ligule and base of the sporophylls of two kinds, macrosporangia with usually 4 (2, 4 or 8) macrospores, larger and 2–4-valved, and microsporangia which contain microspores, smaller and usually 2-valved.

The development of the sporangia and spores is much the same as in the *Lycopodiaceæ*. The spores are usually echinate. The macrospores develop a small-celled meniscus-shaped tissue in the apical region which never leaves the spore, but becomes exposed by a 3-rayed aperture on the spore and developes one or more archegonia and is the rudimentary prothallium. The cavity of the spore becomes filled with a large-celled tissue which may be homologous to the endosperm of *Gymnosperms*. The microspores produce a very rudimentary 1-celled prothallium and a simple antheridium.

1. SELAGINELLA, *Spring.*

(The only genus.)

I. Leaves all similar, imbricate all round the stem . . . 1. *rupestris.*
II. Leaves ventral and dorsal dissimilar, in two planes :—
  A. Sporophylls all similar to one another :—
    1. Small fugacious species, branched from the base :—
      Sporophylls like the larger leaves. Stem decumbent . 2. *exigua.*
      Sporophylls not like the leaves. Stem ascending . 3. *flaccida.*
    2. Persistent, trailing, and rooting along the stem, 2–3-pinnate from near the base (or suberect in forms of *plumosa*). Leaves entire :—
      L. oblong obtuse or subacute, flaccid, nearly equilateral, base not imbricate over stem, ciliate . 4. *semicordata.*
      L. oblong-lanceolate, acute, firmer, acroscopic side larger and imbricate over ventral side of stem, base ciliate . . . . . 5. *plumosa.*
    3. Persistent with stems erect rigid and unbranched below :—
      a. Sporophylls cuspidately acuminate, much exceeding capsules :—
        i. Frond not curling up (or slightly curling in drought in *caulescens*), surfaces nearly concolorous :—
          L. with white closely ciliolate margins, dorsal cuspidate . . . . . 6. *caulescens.*
          L. glabrous or with few cilia, dorsal acute . 7. *pentagona.*
        ii. Frond markedly curling especially in drought, deep green above, very pale or white beneath. . 8. *bryopteris.*
      b. Sporophylls orbicular, scarcely exceeding the capsules . . . . . 9. *fulcrata.*

B. Sporophylls of two kinds like the leaves. Small fugacious species:—
Stem decumbent and rooting at intervals . . . 10. *proniflora.*
Stem erect or ascending, rooting only at base . . 11. *tenera.*

1. S. rupestris, *Spring.*

A small *Lycopodium*-like plant with densely cæspitose decumbent and ascending mostly monopodially branched stems only a few inches high or attaining 6–12″ in length, with distant usually pinnately arranged branches. Leaves all round the stem, similar to one another, close, erect or ascending, linear or subulate, ·1–·2″ long without the long hair-tip, margins minutely ciliolate. Spikes or flowers scarcely differentiated, sessile, ·5–1″ long by ·04″ diam., sporophylls rigid, ovate-lanceolate, acute, much imbricated, acutely keeled.

On rocks, higher mountains of Chota Nagpur above 3000 ft. Parasnath! Fr. Nov.

In our plant the base of the leaves is bearded. The plant becomes closely curled up in the cold season.

2. S. exigua, *Spring.*

A very small plant with densely tufted slender stems 1·5–2″ long, decumbent with roots from the lower half only; branches closely pinnate, lower compound. Leaves in two planes, crowded on the branches, laxer on the main stems, membranous, pale green, ·06–·1″ long, those of the upper plane somewhat smaller, obliquely ovate, acute, subcordate and shortly ciliate on the acroscopic edge at the base, those of upper plane cuspidate. Sporophylls altogether like the leaves, or slightly larger (*not* smaller as in most *Selaginella*), and those of the upper and lower plane scarcely different, ovate, acute keeled, the flower axis about ·08–·1″ long only. Sporocarps pale yellow, ·02″ diam.

Ranchi, Hundrughagh, *Prain* (the specimen called *proniflora*)! It is probably much more common on damp rocks than would appear from the single collection. The Hundrughagh waterfall, however, is a very special locality. Somewhat like *proniflora* before the latter flowers (although the dorsal leaves are much smaller than the ventral in *proniflora*). Unless looked at closely the flowers of *exigua* are not at all evident; in *proniflora* they are very evident.

3. S. flaccida, *Spring.*

Stems suberect 6″–1 ft. long with roots only near the base and copious pinnately arranged short erecto-patent copiously compound branches down to the base. Distinctly dorsiventral. Leaves membranous (but not nearly so thin as in *exigua* and *proniflora*), ventral larger, often contiguous on the branches, ovate-oblong, acute, base subequal, neither ciliate nor imbricated over the stem, ·08″ long, dorsal leaves more than half as long, rather oblique, strongly cuspidate. Flowers copious slender ·5–1″ long, with lanceolate cuspidate erecto-patent sporophylls ·06″ long.

Koderma, Hazaribagh on wet banks! Fl. Nov.–Dec.

4. S. semicordata, *Spring.* Syn. Lycopodium semicordatum, *Wall.* (No. 126 part).

A slender procumbent plant often 1 ft. long copiously pinnately branched; stem pale bisulcate above, main branches short rather

remote, flaccid, somewhat pyramidal. Lower leaves spreading or rather ascending oblong or oblong-lanceolate, ·08–·12″ long, obtuse or subacute, paler green or less firm in texture than in *plumosum*, nearly equal-sided, the acroscopic side not dilated at the base nor imbricate over the stem, eciliate, midrib distinct. Dorsal leaves one-third to one-half as long, much imbricate, falcate or obliquely broadly oblong, suddenly cuspidate or awned. Spikes square ·25–·5″ long with ovate suddenly acute or sub-cuspidate strongly keeled bracts.

Rajmahal Hills, *Wall.*! Fl. Aug.

Wallich's No. 126 contains two or three species. I take the left-hand plant on the sheet bearing his full ticket to be the type. *Spring*, however, appears to have taken a different sheet.

5. **S. plumosa,** *Baker.* Syn. Lycopodium plumosum, *L.*

Stem pale trailing ·6″–1 ft. long, often forked low down, copiously pinnately branched, faces generally flat, roots extending to upper nodes. Larger leaves contiguous on the branches, spreading or rather ascending, bright green, firmer than in *semicordata*, oblong- to ovate-lanceolate, acute, ·08–·12″ long, produced on the acroscopic side of the distinct midrib and imbricated over the (lower face of) rhachis, ciliate on both sides at the base; smaller (dorsal) leaves half as long, ovate, cuspidate, much imbricated. Spikes square, ·2–·5″ long, bracts ovate-lanceolate acute or subcuspidate, strongly keeled.

The above is mainly *Baker's* account of *S. plumosa* to which species form *tetragonostachya, Wall.*, a dwarf suberect form, is assigned. This is not very easy to separate from some specimens included in *caulescens.*

Monghyr Hills, *Ham.* (forma *tetragonostachya*). Fl. Sept.

Spring quotes the above plant under his "*chrysocaulos*" but surely in error, as *chrysocaulos* belongs to the section with unilateral spikes and dimorphic bracts.

Baker describes the bracts as acute. They are lanceolate and cuspidate in *Hamilton's* plant, ·07″ long.

6. **S. caulescens,** *Spring.*

A pretty plant with erect stem 6–12″ high simple rigid and with distant leaves below, deltoid and pinnately decompound above. Pinnæ close deltoid with copious subflabellately compound lower pinnules and contiguous ascending final branchlets ·25–1″ long, ·12″ broad, liable to curl up in drought. Ventral leaves crowded ovate or broadly lanceolate falcate acute ·05–·1″ long, firm, bright green, rather unequal-sided, with fine microscopically serrulate white margins broadly rounded at base and slightly imbricated over (ventral side of) the stem, nerves usually 2; dorsal leaves one-fourth to one-half as long, ovate, with oblique semicordate base, cuspidate, much imbricated. Flowers (or spikes) 4-angled ·2–·5″ long, sporophylls ovate cuspidate or aristately acuminate.

Hills of Chota Nagpur, frequent in shady forest, all districts!

The common Chota Nagpur plant does not always quite agree with *caulescens* in the following particulars and there may be two species here. Chiefly the leaves in many specimens are not 2-nerved*; whereas *Baker* describes them as shortly ciliate on the basal upper edge ours are minutely white ciliolate all round but in this respect agreeing better with *Spring's* account; dorsal leaves often half

* The 1-nerved specimens might belong to the erect variety of *plumosa*. I had no opportunity of comparing them with this.

as long as ventral, but described by *Baker* as one-fourth to one-third as long only. The female capsules are sessile tetrahedral with 4 large macrospores.

7. S. pentagona, *Spring.*

Stems at first erect, simple and with sparse leaves below, elongate and sometimes falling over and rooting at the end, unequally pentagonously striate, pinnately branched and lower pinnæ decompound deltoid, final branchlets contiguous inclined forward ·25–1″ long. Lower cauline leaves rigid, remote decurrent and sub-2-auricled, those on main branches contiguous, ascending, ovate-lanceolate oblique or somewhat falcate, acute, ·08–·12″ long, not or obscurely ciliate, broadly rounded and much imbricate over the stem at the base; dorsal leaves one-fifth to one-third as long, oblong-lanceolate, acute, contiguous. Flowers 4-angled, short, with ovate-lanceolate strongly keeled sporophylls.

Parasnath, *fide Baker.*
The fronds are much more elongate than in *caulescens* and more or less narrowly lanceolate in outline.

8. S. bryopteris, *Baker.* Syn. S. tamariscina, *Spring*; Lycopodium bryopteris, *L.*; L. circinale, *L., & Herb. Ham.*

Erect or suberect with well developed scaly stems, whole plant 6–12″, stem often half to two-thirds as long. Frond deltoid or decompound, deep green above, pale or silvery beneath, readily curling up on dry or hot days. Primary and secondary branching pinnate, ultimate divisions between pinnate and flabellate. Larger leaves much imbricate, ascending, ovate, cuspidate, ·04–·06″ long or attaining ·1″ on the stem (including the cusp), upper leaves nearly as long, oblique ovate with fine arista or cusp often as long as the blade. Spikes or fls. short square, ·04″ diam. with ovate cuspidately acuminate strongly keeled bracts or sporophylls.

Bihar, *Ham.*! Dry forests, Singbhum! Kaimur Hills, *Levinge*! Fl. c.s.
A distinct easily recognizable species.

9. S. fulcrata, *Spring.*

Erect or suberect, 8–15″ high, primarily monopodially branched, with the main branches opposite or subopposite and main stem simple below with very distant appressed leaves, younger branches subdichotomous with wavy pubescent rhachis. Ventral leaves oblong ·08″ long, subobtuse, often revolute at both margins nearly equal-sided; dorsal leaves dimidiate-oblong, the inner margin being straight and contiguous to that of the opposite row, ·03–·04″ long. Flower ·2″ long, 4-angled, sporophylls ·05″ long, and slightly concave orbicular; sporocarps ·02–·03″ long, broad, transversely oblong slightly reniform with a minute attachment point in sinus, nearly as long as the short sporophylls.

Sameshwar Hills! and Bettiah forests, Champaran! Fl. Dec.
A very pretty and distinct species. The rhachis is sometimes only pubescent at the bases of the leaves. Final branchlets ·25–·5″ long only on a somewhat zigzag rhachis. Dorsal leaves neither acute nor cuspidate.

10. S. proniflora, *Bak.* Syn. Lycopodium imbricatum, *Roxb.*

Very slender decumbent and rooting at intervals, 2–4″ long, often

forked at the base, copiously pinnately branched with simple or only slightly compound oblique branches. Leaves membranous, rather distant except below tips of branches, ventral spreading ovate acute ·07–·08″ long, pale green, unequal-sided, ciliate, with cordate base and much imbricated over the stem on the upper side at the base; dorsal about half as long, cordate-ovate, acute and with a hair-tip (not cuspidate, *Baker*). Flowers ·25–·75″ long with sporophylls in two planes as the leaves, but twisted so that the larger sporophylls are in the plane of the smaller leaves, larger dorsal erecto-patent much imbricated oblong-lanceolate, nearly equalling the ventral leaves, ventral paler, pointing more forward, shorter, ovate, cuspidate, strongly ciliate.

Very common on wet banks, rocks, etc., in the forests, sometimes forming a mat over which the *S. caulescens* grows like a fairy forest! Fl. Nov. and disappears in the dry season.

11. S. tenera, *Spring.*

Stems ·5–1″ long, erect from the base or decumbent below and ascending, copiously pinnate with the flaccid erecto-patent branches much compound. Ventral leaves ascending and nearly contiguous on the branchlets, lax and squarrose on main stem, oblong-rhomboid, subacute, ·08–·12″ long, very membranous, unequal-sided, broadly rounded and a little imbricate over the stem on the upper side at the base, serrulate; dorsal leaves very small, lanceolate, cuspidate. Flowers short with the position of the sporophylls reversed as in *proniflora*, larger lanceolate rhomboid or upper ovate, smaller ovate cuspidate.

Barkuda Island (Chilka Lake), *C. & N.*

DIVISION—GYMNOSPERMÆ.

(See Introduction. This Division and the Pteridophyta should logically be placed before the Dicotyledons, which were dealt with first as being in our area the most important.)

FAM. 1. CYCADACEÆ.

Shrubs or small trees, with a thick simple (rarely forking) stem and terminal crown of leaves, or stemless with leaves arising from a tuberous simple or branched rootstock. Leaves in alternate series of short coriaceous scales and of palm-like pinnate (rarely 2–3-pinnate) leaves with membranous or coriaceous leaflets. Flowers dicœcious; males in one or more terminal cones formed of numerous fleshy flat or variously peltate scales bearing on their underside crowded 1-celled anthers; females of flat carpellary leaves (carpophylls) crowded round the apex of the stem (in *Cycas*) or of flat or thickened variously peltate scales arranged in cones. Ovules large, sessile, orthotropous, either numerous and erect in notches on either margin of the carpophyll or solitary and inverted on either side of the peltate scales. Seeds large, drupaceous, with more or less fleshy external and crustaceous or bony internal coat. Albumen copious with one or more embryo sacs. Embryo usually one by abortion, slender, radicle superior attached to the crumpled suspensory cord. Cotyledons 2.

1. CYCAS, *L.*

Shrubs or trees with a simple or rarely branched cylindric trunk clothed with the woody bases of the petioles. Leaves in terminal crowns, linear-oblong, pinnate, leaflets linear entire, 1-nerved, involute in vernation, lower often reduced to spines. Male cones apparently terminal (finally thrust aside by growth of stems), peduncled; scales cuneate, closely imbricate, apex often long-acuminate upcurved, anthers in groups of 3–5. Carpophylls numerous, crowded round apex of the stem, densely woolly, appressed at first into an apparently terminal cone, then spreading (and stem continuing its growth through them), elongate, flattened, dilated above into an entire, crenate or pectinate blade. Ovules 2–10, in notches on the margins of the lower part of the carpophyll, distant, alternate or opposite, nearly erect. Seeds ellipsoid or globose.

Cycadean stems can easily be distinguished from those of the palms with which they are sometimes confused, but in no way allied, by the petiole-scars being arranged in bands, the bands with large scars being those of the large foliage leaves, the small scars those of the alternating scale leaves.

I. Sides of leaflets flat (or margins only recurved in *pectinata*) :—
  A. Blade of carpophylls lanceolate, not very deeply pectinate :—
    Male sporophylls ending in an upcurved spine. Blade of fem. lanceolate toothed or shortly pectinate, teeth sometimes spinous . . . . . 1. *circinalis.*
    Male sporophylls shortly acuminate. Blade of female a long simple acumen without teeth . . . . . 2. *Rumphii.*
  B. Blade of carpophylls orbicular, long-acuminate and deeply pectinate. Male sporophylls deltoid and much thickened with a long abrupt subulate acumen . . . . . 3. *pectinata.*

II. Sides of leaflets revolute. Blade of carpophylls deeply softly pectinate nearly to midrib . . . . . 4. *revoluta.*
Only 1 and 3 are wild in our area.

1. C. circinalis, *L.* Var. orixensis. Oruguna, *Or.*

Trunks mostly 6–15 ft. high. Leaves 5–9 ft. long, petiole 1·5–2 ft. long, laterally spinous to near the base, leaflets 8–12″ by about ·25–·5″ at the widest part, subfalcate, acuminate, margins flat. Male cones about 7″ (where seen by me, but unripe; they are said to attain 18″), scales 1·3–1·5″ to base of the upcurved tip, which is densely tomentose and armed with a sharp 1–3-fid upcurved spine up to ·7″ long, lower part of scale beneath densely covered with pollen-sacs. Female cone (young) about 6″ diam. globose with over 50 carpophylls (usually said to be only 6–12 in *circinalis*), about 6–10″ long including the stalk, brown-tomentose; blade 1·5–2·2″ lanceolate long-acuminate, margin subulate pectinate, with teeth ·2–·4″ long spinose tipped, subulate spine or acumen ·7–1″ long. Ovules 3–5, in recesses below the blade, mostly alternate. Seeds ovoid, pale reddish-yellow, 1″ long.

Wild in the hill forests of the Mals of Puri, especially on the tops of ridges with heavy rainfall! extending to Angul, in open forest, where it is less common! Fl. July–Aug. Some old carpophylls with the fruits fallen were found by me in April; these were no larger than those recorded above.

The spinous character of the antheriferous scales is nowhere mentioned as far as I can ascertain. The lower ones are simply spinous-tipped, the median also spinose-serrate below the often 2-spinose tip. The carpophylls also are not spinous-toothed in the Kew Herbarium, the teeth are lanceolate ·2″ or less.

The stalk or basal portion is obcuneate and the anthers are confined to this portion, which is ·4–·6″ wide at the top, flattened with a median ridge on upper side; from the widest portion the scale is thickened and curved upwards and crenate or spinous as described above.

2. C. Rumphii, *Miq.*

Usually about 4–15 ft. in gardens, often branched. L. 3–6 ft., lflts. 9–15″ by ·5–·7″. Carpophylls with ovate to ovate-lanceolate blade, densely villous, teeth small. Seeds 2–3″ long.

Sometimes cultivated in gardens. Native of Tenasserim, Malacca, etc.

The carpophylls are described in *F.B.I.* as with an ovate-rhomboid blade spinous-toothed above entire below; where I have seen them the blade is a long simple acumen above the linear-oblong fertile portion. Male sporophylls thickened and obliquely truncate at the apex with a short upcurved not spinescent acumen.

3. C. pectinata, *Griff.* Kunth, *Th.*

A small tree 4–10 ft. high with a crown of somewhat recurved leaves 4–5 ft. long. Leaflets narrow-linear 6–10″ by ·25–·3″ wide, subfalcate, tapering into a minute spine, margin slightly reflexed (in my specimens), rhachis and leaflets beneath more or less brown-pilose with deciduous hairs, especially on midrib. Male cone 18″ long and 6″ diam., somewhat ovoid cylindric, antheriferous scales 1·5″ long, 1″ broad, deltoid-clavate with much thickened apex and an abrupt ascending subulate acumen 1·5″ long. Carpophylls 6″, densely tawny-villous all over, stalk about equal in length to the broadly orbicular, long-acuminate blade which is about 3″ diam., deeply cut into strong subulate spinous teeth ·75″ long, and with 1–2

spinous teeth at broad base of acumen. Ovules 4–6. Seeds about 1·5″ long, ovoid.

Along the high banks of ravines in the Sameshwar Hills, Champaran! Fl. Nov.–Dec.

Petiole laterally spinescent. The pith and other soft tissues are full of starch and yield a sago.

4. **C. revoluta,** *Thunb.*

A cultivated species about 6 ft. high with leaves 2–6 ft. long. Petiole thick, quadrangular. Leaflets narrow under ·2″ wide with their margins revolute. Carpophylls 4–9″ long, blade somewhat obovate, laciniate into villous segments nearly to centre, stalk longer than blade with 4–6 ovules.

In gardens only. Native of China and south-eastern Asia.

Male cones 1 ft. long, sporophylls about 1″ truncate and umbonate, covered with pollen sacs to the base. Carpophylls densely tomentose 1·5–2·5″ broad, the blade somewhat obovate-oblong each ending in a short sharp spine. Seed 1″ by ·7″.

FAM. 2. CONIFERÆ.

Trees or shrubs, wood of tracheides with bordered pits, without true vessels (no pores), resin-canals frequent. Leaves rigid, linear or subulate rarely with broad blade, solitary, or fascicled in membranous sheaths. Flowers monœcious or dicœcious. Males catkin-like, deciduous, of many 1–more-celled anthers (scales of the so-called catkins). Fem. of 1 or more sessile naked orthotropous or anatropous ovules seated on or at the base of sporophylls which are usually arranged in more or less perfect cones (and are then called cone-scales), rarely ovule solitary and sometimes terminal, cone scales where present either spiral or decussate in the cone, sometimes with subsidiary placental scales which outgrow the cone-scale proper (see *Pinus*). Fruit of the more or less accrescent cones, rarely a solitary seed with its fleshy coats. Seeds often winged, with thick or thin testa. Embryo axile. Cotyledons 2 or more, albumen copious.

There are so few Coniferæ in our area that I have treated them as a single family. They are more properly an Order or even a Class.

A. Fem. cone with numerous spirally arranged scales. Ovules 2, inverted :—
  L. acicular in membranous sheaths . . . . . 1. *Pinus.*
B. Fem. cone with 6–12 decussate scales. Ovules 2–many on each scale, erect :—
  L. small scale-like imbricate :—
  Cones usually oblong, scales usually thin oblong. Seeds 2 to each scale . . . . . 2. *Thuja.*
  Cones globose, scales usually thick clavate. Seeds more than 2 to each scale, winged . . . . . 3. *Cupressus.*

1. PINUS.

Richly monopodially branched trees with simple acicular leaves, one or more on abbreviated shoots in the axils of membranous scale-leaves, when more than one appearing clustered. Male flowers ("catkins") clustered at the base of leafy shoots of the same year, each surrounded at the base by an involucre of 3–6 scale-like bracts and composed of numerous sessile anthers, imbricate in many rows

with crest-like suborbicular connectives. Female fls. subterminal or lateral, consisting of numerous spirally imbricate sporophylls (open carpels, cone-scales), at the base of which develops the seminiferous scale (ovuliferous scale or placental scale), bearing 2 inverted ovules at the base. The seminiferous scale soon outgrows the cone-scale proper and becomes more or less thickened and woody on the exposed surface. Fruit a woody cone maturing at the end of the second or sometimes third season. Seeds usually winged, cotyledons 3–18.

1. **P. longifolia,** *Roxb.* Chil, Chir, *H.*; Dhup, *Th.*; Long-leaved Pine.

A large tree with symmetrically whorled branches high up the trunk forming a rounded crown. Leaves in clusters of 3 in a membranous sheath, 9–15″ long, slender, nearly triquetrous, sheath ·5–1″ long, greyish-brown fimbriate. Male flowers (catkins) ·5″ long. Fem. cones solitary or in whorls of 3–5, 4–8″ long and 3–5″ diam., scales with thick pyramidal pointed and somewhat recurved beak. Seed ·3″ long with thin membranous wing rather longer than the seed.

Forms gregarious forest on sandstone on some of the Sameshwar Hills, Champaran! Frequent in cultivation in Purneah! Also in Ranchi! Male fl. appear Jan., pollen ripens Feb.–April. The female flower is pollinated at this time and is about ·7–1″ long by the end of Oct. and the cone reaches full size in June–July of the following year. They commence opening in the hot weather of the third season (whole time about 27 months).*

It attains 7·5 ft. girth in the Sameshwar Hills. Bark 1–2″ thick, outer in large plates. Wood weighs 40–50 lb. per cubic ft. It is fairly durable and has been much cut out for building and other purposes. It is used in some match factories (not in our area) and for the production of resin and turpentine.

2. THUJA, *L.*

Trees or shrubs with flattened branchlets and small decussate green scale-like acute leaves bearing stomata on the back, those on leading shoots appressed or spreading, rounded or keeled on back; on lateral branches one series usually much laterally compressed; imbricate or nearly so. Fls. monœcious, minute, solitary, the two sexes usually on different branchlets. Male ovoid with 4–6 decussate filaments enlarged into suborbicular peltate connectives bearing on their inner face 2–4 subglobose anther-cells. Fem. usually oblong (subglobose in our species, which belongs to the somewhat abnormal section *Biota*) or somewhat pyriform with 6–12 oblong decussate scales, some or all bearing seminiferous scales with 2 erect ovules at their base. Fruit an ovoid-oblong (subglobose in *orientalis*) cone with the scales usually thin and coriaceous (thick and angular in sect. *Biota* and in *Cupressus*), those in the middle usually alone fertile. Seeds winged (exc. in sect. Biota).

1. **T. orientalis,** *L.* Sara, *Vern.* (The common name for Thuja and Cupressus.)

A small tree with branchlets often in somewhat vertical planes. Older scale-leaves brown, clothing the older branchlets, about ·1″ oblong or ovate with cuspidate tip, on the youngest branchlets green

* *Indian Forest Memoirs*, vol. i, Part I.

and 4-ranked, imbricate, those on the flatter faces rhomboid, on the narrower faces oblong-ovate and rather blunt. Cones subglobose or compressed pyriform on short lateral scaly branchlets, ·4″ long. Scales usually 6 only, in decussate pairs, thick, umbonate, the umbo developing from the enlarged seminiferous scale to which the thin bract proper is adnate beneath. Two outer scales each with two erect ovules, 2 next each with 2–1 ovules, 2 innermost barren. Ovules somewhat 3-gonous. Seeds 2–3 only, brown ovoid or elongate-ovoid, ·15″ long, 3-angled or subalate.

The most commonly planted conifer in our area. Fl. March. Seed ripens November the same year.

3. CUPRESSUS, *L.* Cypress.

Trees with the bark usually separating into long shred-like scales, wood often fragrant, branchlets slender, 4-angled. Leaves scale-like ovate with slender spreading or appressed tips, thickened rounded and often glandular on back, opposite and decussate. Fls. minute monœcious, the two sexes on separate branchlets, male oblong of many decussate stamens with broadly ovate blades or connectives bearing 2–6 globose pendulose anther-cells. Fem. oblong or subglobose, with 6–10 thick decussate scales. Ovules numerous, bottle-shaped, several-seriate at the base of the seminiferous scale. Fruit a nearly globose cone maturing the second year, scales (seminiferous) abruptly dilated and flattened at apex bearing the unenlarged flower-scale as a short central more or less thickened mucro or boss. Seeds many in many rows, acutely angled or compressed with thin lateral wings.

Several species of *Cupressus* have been introduced into gardens, especially in the Northern Area and on the plateaux chiefly *C. torulosa* and *C. sempervirens*.

FAM. 3. GNETACEÆ.

Woody plants without resin-canals, with vessels in the secondary wood and with simple, large or scale-like, opposite leaves. Fls. dicœcious, monœcious or 2-sexual, with a simple tubular or 2–4-merous perianth. Male with 2–8 stamens or pollen-sacs. Female with flask-shaped perianth and erect orthotropous ovules with 1 or 2 integuments. Seeds as in the Coniferæ. Embryo always with 2 cotyledons.

The three genera of the *Gnetaceæ* are so different, and as only *Gnetum* is likely to be found either wild or in cultivation, the family has been very shortly dealt with. The significance of the so-called perianth is doubtful. It may be an integument of the nature of an arillus or it may represent an ovary open at the top.

1. GNETUM, *L.*

Climbing shrubs with opposite broad penninerved leaves on thickened nodes. Fls. minute monœcious or dicœcious, crowded in the axils of annular cupular bracts on solitary or panicled spikes, mixed with dense cellular hyaline hairs. M. perianth clavate in bud, the apparently single stamen with 2 pollen-sacs breaking through it on a long filament or column and opening by two terminal valves (two anthers with transverse apical dehiscence according to some). Fem.

perianth thick flask-shaped, integument of ovule double, inner with a long neck projecting beyond the outer and with a fimbriate mouth or 3 filiform teeth, outer with 3 minute obtuse teeth or entire. Ovule 1 erect. Fruit drupe-like, the seed enclosed in the fleshy accrescent perianth.

Not easily recognized as a *Gymnosperm*. The ovule simulates a 1-ovuled ovary, with style and stigma represented by the loose integument with its long narrow neck and fimbriate mouth. The perianth *and the integuments* are easily separable from the nucellus.

1. **G. scandens,** *Roxb.* Milgandi, *K.*; Galio, *Or.*; Mirig-lendi (Bonai).

An immense dichotomously branched, woody climber with elliptic oblong or ovate entire glabrous leaves 3–8″ by 2–4″ shortly acuminate base rounded or very obtuse, sec. n. 6–10 each side of stout midrib and with many intermediate nerves. Petiole ·3–·75″ long. Fls. monœcious (dicœcious, *F.B.I.*) in rings among dense cellular hairs, females usually above two rows of males, in the axils of the peculiar annular bracts of the spikes and wholly enclosed by these when young. Spikes 1–3″ long, peduncled, in 3-chotomous panicles. Fem. ovoid. Seed (·25″ only in my specimens ovoid but unripe and) said to attain 1–1·5″ and to become orange-coloured and stipitate while the fruiting spikes are said to attain sometimes 10″ in length.

In the more evergreen forests. Mountain valleys in Singbhum! Bonai, *Cooper*! Mayurbhanj, 3000 ft.! Puri, in the Mals! Fl. April–May.
The fruit is eaten according to the Kols, but I have not seen it.

APPENDIX I.

LIST OF SPECIES FROM BIHAR AND ORISSA FOUND IN THE WALLICHIAN HERBARIUM AT KEW.

The families and genera are arranged in the order adopted in the *Flora*, and the specific names given in the first column are also those of the *Flora*, so that the authority has not been repeated. After the specific name is given the Wallichian number. Next the name given on Wallich's or Hamilton's tickets are, where these differ from the name adopted, added in italics. This is the more necessary as one Wallichian number includes specimens from many localities, and also sometimes different species. Moreover Hamilton's names have an interest in themselves. They are usually "*noms de plume*" embodying the supposed genus and some obvious character (*e. g. Echites pubescens*) or the vernacular name in the locality where collected (*e. g. Nerium coraia*). The bulk of the specimens from our area are of Hamilton's collection; those of 1820 especially are Wallich's own collection. The precise locality has fortunately usually been given as well as the date, but many of the small villages are difficult to locate, and the construction of an itinerary has had to be relied upon to fix those villages which fall within the limits of our area. Prain's *Life of Buchanan Hamilton* has also been found useful. The place Nathpur, so often occurring on tickets, is in Bhagalpur, not far from the Kosi river and close to the place marked Pratabganjghat on the map attached to this work. From this place Hamilton appears to have made excursions during 1810 not only into the surrounding country, but often extending across the Nepal frontier. Hence the plants collected at Siupur, Sukranagar and other places bearing similar dates to those from Nathpur but which are apparently across the frontier have had to be deleted from the list. Even some of the plants labelled Nathpur itself, although included, were possibly collected outside British territory, perhaps on short day excursions. Such is *Anaphalis araneosa*. There is a place Chainpur in Shahabad, but the Chainpur Hills are now found to be the Chainpur Hills near the Arun River in Southern Nepal, not those near Chainpur in Shahabad. There is also a Chainpur in Bhagalpur and not far from Nathpur. Although Hamilton surveyed Shahabad practically no specimens of his are found from that district, and he did not go there till the rainy season of 1913 (*vide Prain* in *Life of Buchanan Hamilton*). Koemore, again, does not refer to the Kaimur Hills of Shahabad, but apparently to a place in Goalpara. Kumarganj is in Bhagalpur, just south of the Ganges and not far from Monghyr. Dariyapur is

in Gaya; Maghada is the old name for Bihar and Puraniya for Purneah. Saefganj is in Purneah. Bihar refers to the town (not district) of that name in Patna. Kalkapur is in Bhagalpur, Sheikpura in the Santal Parganahs, Kisanganj in Purneah, Bhimnagar in the north of Bhagalpur not far from the frontier, Paingti in the Santal Parganahs, Bangsi in Patna, Barh in Patna, Arval in Patna, Risikhund in Monghyr, Manihari is on the Ganges on the Purneah side of a crossing from the Santal Parganahs. Paturghata is in northern Bhagalpur on the south side of the Ganges. Nawada is in the south of Gaya, Burhisimar in the Santal Parganahs, Dumraon in Shahabad, Thakurganj in Purneah, Ratanganj in Bhagalpur, Banka in Gaya. The few other places mentioned are either on the map attached or in the Maldah, Jalpaiguri and other districts near our boundary and only concern species already mentioned in the *Flora*.

FAM. 1. RANUNCULACEÆ.

Nigella sativa, No. 4712 *N. indica*, Kumarganj.

FAM. 2. DILLENIACEÆ.

Dillenia pentagyna, No. 949, Monghyr.

FAM. 4. ANONACEÆ.

Uvaria Hamiltoni, No. 6485, *U. grandiflora*, Monghyr 26 May 1810.
Polyalthia longifolia, No. 6442 *Guateria longifolia*, Patna.
P. cerasioides, No. 6436 *Guateria cerasioides*, Monghyr 27 April 1811, fl. and fr.
P. suberosa, No. 6437 *Guateria suberosa*, Monghyr 13 Oct. 1811.
Miliusa velutina, No. 6441 *Guateria velutina*, Monghyr 27 April 1811, fl.
Saccopetalum tomentosum, No. 6472 *Uvaria Chandana*, Monghyr 3 May 1811.

FAM. 5. MENISPERMACEÆ.

Cissampelos pareira, No. 4979 *C. convolvulacea* and *C. septemnervia*, Rajmahal and Monghyr 20 July, 10 Sept. and 7 Aug.
Tinospora cordifolia, No. 4955 *Cocculus cordifolia*, Monghyr 3 May 1811, fl.
Cocculus hirsutus, No. 4957 *C. villosus*, Monghyr 30 April 1811, fl. and fr.

FAM. 7 NYMPHÆACEÆ.

Nelumbium speciosum, No. 7259, Patna.

FAM. 10. CRUCIFERÆ.

Eruca sativa, No. 4800, Patna 6 April. Pods up to 1·2″ long including the ·2–·3″ long beak.

FAM. 11. CAPPARIDACEÆ.

Cleome viscosa, No. 6968 *Polanisia viscosa*, Monghyr 19 June 1811, fl.
Capparis sepiaria, No. 6993, Patna and Monghyr, 26 April 1812 and 27 April 1811.

FAM. 14. FLACOURTIACEÆ.

Flacourtia ramontchi var. **occidentalis,** No. 6675 *F. sapida*, Sukanagar.
F. cataphracta, No. 6674, Monghyr 5 May 1811, fl.
Casearia graveolens, No. 7195 *Samyda glabra*, Monghyr 4 June 1811.

FAM. 16. POLYGALACEÆ.

Polygala chinensis, No. 4170 *b* and *d P. telephioides*, Monghyr and Nathpur 4 Aug. and 13 June. Wing petals falcate or hatchet-shaped in fruit and glabrous. Capsule margined and ciliate only on margin.
P. erioptera, No. 4170 *c* and *b P. quinqueflora* and *P. senduaris*, Monghyr and Patna 14 Aug. and 25 March. Wing petals elliptic, never falcate but sometimes contracted and somewhat oblique at base in fruit, ·15–·18″ long. Capsule margined, oblong ellipsoid and obliquely notched, mostly pubescent.

FAM. 17. CARYOPHYLLACEÆ.

Dianthus chinensis, No. 656 *D. glaucus*, Patna 29 March. Doubtless cultivated.
Polycarpon Lœflingiæ, No. 6962 *Hapalosia Lœflingiæ*, Monghyr.

FAM. 18. PORTULACACEÆ.

Portulaca tuberosa, No. 6844 *P. cristata*, Monghyr 24 June 1811.
P. oleracea, No. 6841 *P. lævis*, Monghyr 11 May 1811.
P. quadrifida, No. 6943 *P. meridiana*, Patna 18 Aug. 1812.

FAM. 19. AIZOACEÆ.

Mollugo stricta, No. 650 *M. pentaphylla*, Monghyr 23 May, fl. fr. Capsule globosely oblong.
M. spergula, No. 653 *Pharmaceum rigidum*, Patna. Leaves linear-lanceolate.
Trianthema monogyna, No. 6837 *T. obcordata*, Patna and Monghyr 2 May 1812 and 6 June 1811.
T. pentandra, *L.*, No. 6838 *T. govindia*, Monghyr 1 June 1811. *Vide* p. 1253.

FAM. 20. ELATINACEÆ.

Bergia ammanoides, No. 655 and 655 *b Dulachera ammanoides* and *Leihea verticillata*, Monghyr 29 May, etc.

FAM. 21. TAMARICACEÆ.

Tamarix dioica, No. 1241, Ganges near Rajmahal Aug. 1820.

FAM. 23. GUTTIFERACEÆ.

Garcinia oowa, No. 4863, Monghyr 27 April 1811.
Mesua ferrea, No. 4835, Nathpur.

FAM. 26. MALVACEÆ.

Malva verticillata, No. 1894 *M. rotundifolia*, Patna 12 April 1812, fl., fr.
Sida glutinosa, No. 1874 *S. olans*, Nathpur.
S. cordifolia, No. 1849, Nathpur 2 Oct. 1811.
S. spinosa, No. 1872 *S. boriaria*, Monghyr 15 May 1811.
S. rhombifolia, No. 1862 *S. rhomboidea*, 24 Aug. 1811.
Abutilon indicum, No. 1858 *Sida populifolia*, Monghyr Aug. 1820, fr.
Urena lobata, No. 1929, Nathpur 24 Sept. 1810.
U. sinuata, No. 1932 Monghyr, 30 Sept. 1811.
Hibiscus pungens, No. 1919 *Bamia magnifica*, Rajmahal 1820.
H. solandra, No. 1876 *H. albus*, Monghyr 30 Sept. 1811.
H. cannabinus, No. 1898, Monghyr 13 Oct. 1811.
H. hirtus, No. 1904 *H. phœniceus*, Monghyr 15 May 1811. The gland on mid-rib beneath is mostly absent in this specimen.
H. syriacus, No. 1891, Patna. No doubt cultivated.
H. mutabilis, No. 1907, Patna 20 April 1812. No doubt cultivated.
H. vitifolius, No. 1899, Patna.
Althæa chinensis, No. 2689, Patna. Cultivated.
Gossypium arboreum var. **neglecta**, No. 1880 *G. viridescens*, Nathpur 18 Sept. Ditto dated 14 Oct. is the same hybridized (according to Watt) with *nanking*.

FAM. 27. STERCULIACEÆ.

Sterculia colorata, No. 1119 *S. rubicunda*, Monghyr, fl. 5 April 1911, leaf 20 July 1911.
Helicteres isora, No. 1179, Monghyr.
Pentapetes phœnicea, No. 1157, Monghyr 6 Sept. 1911, fl. and fr. Leaves up to 7″ by ·8″ at the base. Capsule subglobose-oblong ·5″.

FAM. 28. TILIACEÆ.

Triumfetta neglecta, No. 1075 *T. pentandra*, Monghyr 22 Sept. 1810.
T. rhomboidea, No. 1075 (part) *T. angulata*, Nathpur 28 Sept. 1810.
Corchorus acutangulus, No. 1096 *C. fuscus*, Nathpur 24 Sept. 1810.
Grewia hirsuta, No. 1091, Monghyr 20 July 1811, fl.
G. tiliæfolia, No. 1094, Dumka, leaves only, Monghyr 17 May 1811, fl.
G. Hainesiana, No. 1089 *G. asiatica*, Patna, 5 May, fr.
G. araria, No. 6308, Monghyr. This requires further examination. It appears to be a hybrid of *G. Rothii* and *G. elastica* form *elatostemoides*.

FAM. 29. EUPHORBIACEÆ.

Chrozophora prostrata, No. 7716 *C. plicatum*, Patna 31 March 1812.
Trewia nudiflora, No. 7837 *Rottlera indica*, Monghyr.

Acalypha indica, No. 7779, Monghyr 16 July 1811 and Bhagalpur 30 Oct. 1811.
Tragia involucrata, No. 7791, Monghyr 4 Aug. 1820.
Claoxylon mercurialis, No. 7790 *Tragia mercurialis*, Monghyr Aug. 1820.
Bridelia montana var. **Hamiltoniana**, No. 7882 *B. Hamiltoniana*, Monghyr 3 Sept. 1811.
B. stipularis, No. 7879 *Cluytia scandens*, Rajmahal Aug. 1820.
Sapium sebiferum, No. 7972, Patna.
Phyllanthus urinaria, No. 7893, Monghyr 4 June 1811.
P. niruri, No. 7895, Monghyr 16 May and 17 June, 1811.
P. simplex, No. 7899, Monghyr 4 June 1811.
P. debilis, No. 7892, Monghyr 5 July 1811.
Sauropus quadrangularis, No. 7892 (same sheet) *Phyllanthus myrtellus*, Monghyr 5 July 1811.
Glochidion multiloculare, No. 7864 *Bradleia multilocularis*, Monghyr 23 June 1811 and Rajmahal 7 Aug. 1820.
Putranjiva Roxburghii, No. 6814, Monghyr 17 Aug. 1820 and Patna 5 April 1812.
Euphorbia thymifolia, No. 7710 *E. granulata*, Patna 4 May 1812.
E. granulata, No. 7710 (same sheet), Monghyr 6 June 1811, but specimens confused and the tickets special to each uncertain.

FAM. 23. ZYGOPHYLLACEÆ.

Tribulus terrestris, No. 1191, Monghyr Aug. 1810.
Ditto, No. 6854, Bhagalpur 3 Nov. 1810, fr.

FAM. 34. GERANIACEÆ.

Biophytum sensitivum, No. 4343 *Oxalis sensitiva*, Monghyr 24 Aug. 1811.

B. apodiscias, No. 4344 *Oxalis debilis*, Monghyr 7 July 1811.

FAM. 25. BALSAMINACEÆ.

Impatiens balsamina, No. 4732 *I. laxa*, Nathpur 17 July 1810.

FAM. 36. RUTACEÆ.

Limonia acidissima, No. 6364, Monghyr 3 May 1811, fl.
Glycosmis pentaphylla, No. 6374, Monghyr 10 May 1811, fl.
Murraya exotica, No. 6368, Patna (no doubt from a garden) and Monghyr, probably indigenous, 10 May 1811.
Citrus medica, No. 6387, Patna 31 March 1812. No doubt cultivated.
C. aurantium, No. 6390, Gaya, leaves only. Cultivated.
Feronia elephantum, No. 6380, Monghyr 5 May 1811, fl.

FAM. 37. SIMARUBACEÆ.

Ailanthus excelsa, Nawada and Patna, 20 Dec. 1811, fl., and 13 April 1812, fr.

FAM. 39. BURSERACEÆ.

Bursera serrata, No. 8492 *Icica indica*, Rajmahal Aug. 1820.

FAM. 42. OLACACEÆ.

Olax scandens, No. 6774, Rajmahal.
Ditto, No. 6778 *O. bador*, Monghyr. From this it would appear that *bador* is the vernacular name also in Monghyr.

FAM. 44. CELASTRACEÆ.

Celastrus paniculata, No. 4301 *C. malcanei*, Nathpur 8 April 1810.
Hippocratea indica, No. 4210, Monghyr 17 May 1811, fl.

FAM. 46. RHAMNACEÆ.

Zizyphus jujuba var. **fruticosa,** No. 4245 *Z. mauritiana*, Dariyapur 22 Oct. 1811.
Z. Œnoplia, No. 4246 *Z. napeca*, Rajmahal 7 Aug. 1920, fl.

FAM. 47. AMPELIDACEÆ.

Vitis tomentosa, No. 6004 *V. obtusifolia*, Monghyr, 29 July 1811, fl.
V. auriculata, No. 6031, Rajmahal ripae gangis, Aug. 1820, leaf only.
Leea aspera, No. 6829 *L. herbacea*, e silvis Maghada.

FAM. 49. SAPINDACEÆ.

Cardiospermum halicacabum, No. 8030, Monghyr 28 Aug. 1811, fl., fr.
Sapindus emarginatus, No. 8039, Behar 5 Jan. 1812, fl.

FAM. 51. ANACARDIACEÆ.

Semecarpus anacardium, No. 986 *Anacardium latifolium*, Monghyr 11 June 1811.

FAM. 52. MORINGACEÆ.

Moringa oleifera, No. 5814 *Moringa sylvestris*, Patna (no doubt cultivated) 1812.

FAM. 53. PAPILIONACEÆ.

Crotalaria prostrata, No. 5388 *C. obliqua*, Monghyr 9 Oct. 1811.
C. hirsuta, No. 5413, Monghyr 6 Sept. 1811, with lanceolate-ovate leaves.
C. medicaginea, No. 5434, Monghyr 26 Sept. 1811.
Trigonella fœnum-græcum, Puraniya 6 Feb. 1810.
Melilotus alba, No. 5942, Puraniya 5 Feb. 1810. Lflts. sharply dentate, 1″. Racemes 3–4″. Fls. ·15″.
Medicago lupulina, No. 5944, Sæfganj, 13 Feb. 1810.

M. sativa, No. 5945, Patna 22 April 1812.
Cyanopsis psoralioides, No. 5920 *Trigonella goalia*, Monghyr 9 Oct. 1811.
Indigofera enneaphylla, No. 5444, Monghyr 24 June 1811.
I. trifoliata, No. 5448 *I. canescens*, Nathpur 23 Aug. 1810.
I. hirsuta, No. 5450, Nathpur 12 Sept. 1810.
I. articulata, No. 5460 *I. cærulea*, Patna 9 April 1812.
Psoralea corylifolia, No. 5351, Gour 19 Nov. 1809.
Tephrosia Hamiltonii, No. 5642 *Galega sericea*, Monghyr.
Millettia auriculata, No. 5892 *Pongamia macrophylla*, Monghyr.
Abrus precatorius, No. 5818 *Dolichos precatorius*, Nathpur 21 Sept. 1810.
Vicia hirsuta, No. 5955 *Ervum hirsutum*, Sæfganj 15 Feb. 1810, fl., fr.
Lens esculenta, No. 5954 *Ervum lens*, Puraniya 5 Feb. 1810, fr.
Alhagi camelorum, No. 5760 *A. maurorum*, Monghyr 17 June 1811, fl.
Zornia diphylla, No. 5660 *Hedysarum diphyllum*, Monghyr 6 Sept. 1811.
Smithia sensitiva, No. 5668, Nathpur 10 Sept. 1810.
Alysicarpus bupleurifolius, No. 5761, Nathpur 1 Oct. 1810. Probably var. *erecta*. In young bud only. L. with yellow flush and appressed needle-shaped hairs on the nerves beneath.
Ditto var. *typica*, with few fine needle hairs, No. 5762 *A. ludens*, Nathpur 12 Sept. 1810.
A. monilifer, No. 5769 *Hedysarum moniliferum*, Monghyr 3 Sept. 1811, fl., fr.
A. vaginalis, No. 5771 *Hedysarum rubibarna*, Monghyr, bud 6 Sept. 1811.
Ditto No. 5772 *Hedysarum vaginale*, Nathpur 1 Sept. 1810, fl.
Desmodium gangeticum, No. 5689 *Hedysarum gangeticum*, Monghyr 26 Sept. 1811.
Ditto var. **maculatum,** No. 5690 *Hedysarum maculatum*, Nathpur 11 April 1810.
Desmodium triflorum, No. 5734, Patna and Monghyr 25 March 1812 and 22 April 1811.
Ditto, ditto, Nathpur 2 Oct. 1810.
Flemingia semialata, No. 5746 *F. bhottea*, Nathpur 17 May 1810.
Rhynchosia minima No. 5496 *R. prostrata*, Sukaraghar; no date and locality uncertain.
Atylosia scarabæoides, No. 5590 *Cajanus scarabæoides*, Nathpur and Monghyr 30 Aug. 1810 and 16 Sept. 1811.
A. crassa, No. 5553 *Dolichos crassus*, Kalkapur 13 Dec. 1810.
Butea frondosa, No. 5569, Puraniya 6 Feb. 1810, fl.
B. superba, No. 5438, Monghyr 18 April 1811, fl.
Erythrina suberosa, No. 5964 *E. tomentosa*, Monghyr 20 July 1811.
Phaseolus trilobus, No. 5589, Monghyr 6 Sept. 1811.
P. radiatus var. **typica,** No. 5589 *P. mungo*, Nathpur 30 May 1810.
P. radiatus var. **grandis,** No. 5606 *P. max*, Bhagalpur 5 Nov. 1810.
P. calcaratus, No. 5598 *P. sublobatus*, Sibganj 21 Nov. 1809.
P. mungo var. **Wightianus** (*F.B.I.* ii, p. 203), No. 5605 *P. subvolubilis*, Monghyr 5 Oct. 1811. The *F.B.I.* describes it as "stems elongated slender flexuose finely hairy, the hairs short and grey,

leaflets thinner." It is not mentioned in *Beng. Pl.* and I have not been able to examine it.

Vigna catjang, No. 5549 *Dolichos catjang,* Bhagalpur 5 Nov. 1810. Pods linear, seeds black square. Monghyr 14 Aug. 1811, young fruit.

Ditto var. **sinensis,** No. 5550 *Dolichos sinensis,* Monghyr 5 Oct. 1811. Pod linear 15″.

Dolichos lablab var. **lignosus,** No. 5537, Pirganj 9 Jan. 1809.

Pterocarpus marsupium, No. 5842 *P. vijaya,* Siupur April.

Derris scandens, No. 5905 *Pongamia coriacea,* Monghyr 29 July 1811.

Pongamia glabra, Patna.

FAM. 54. CÆSALPINIACEÆ.

Cassia absus, No. 5314, Monghyr 26 Sept. 1811, fl., fr.

C. mimosoides, No. 5321 *C. amœna,* Maldah 17 Jan. 1808.

C. pumila, No. 5227, Monghyr 16 Sept. 1811, fr.

C. glauca, No. 5311 *C. frondosa,* Gaya.

Bauhinia racemosa, No. 5789, Monghyr 10 May 1811.

B. tomentosa, No. 5790, Patna, 28 April 1812.

B. variegata, Monihari 20 Feb. 1810, fl.

Cæsalpinia digyna, No. 5839 *C. oleosperma,* Bhagalpur 3 Nov. 1810.

FAM. 55. MIMOSACEÆ.

Leucæna glauca, No. 5239 *Acacia caronja,* Patna 14 March 1812.

Mimosa angustosiliqua, *Gamble* (type), No. 5289 *M. rubicaulis,* Bagdwar 14 Jan. 1809. The name was subsequently altered by *Gamble* to *M. Barberi.*

Dichrostachys cinerea, No. 5231 *Desmanthus cinerea,* Patna 23 April 1812.

Acacia catechu proper, Monghyr 26 June 1811, fl., and Rajmahal Aug. 1820.

A. torta, No. 5249 *A. arar,* Monghyr 10 May 1811.

A. lenticularis, Rajmahal, Jan. 1811.

Albizzia odoratissima, No. 5234 *Acacia biluara,* Monghyr 3 May 1811, fl.

A. lebbek, No. 5265 *Acacia sirissa,* Monghyr 27 April 1811, fl., fr.

FAM. 56. ROSACEÆ.

Rosa semperflorens, No. 685 *R. indica,* Nathpur 17 July 1810. Cultivated.

R. involucrata, No. 696, Nakeswari 16 Feb. 1809.

Eriobotrya japonica, No. 666, Gya 7 Dec. 1811, fl. Cultivated.

FAM. 57. SAXIFRAGACEÆ.

Vahlia viscosa, No. 7188, Sheikhpura 1 Jan. 1811.

FAM. 62. COMBRETACEÆ.

Terminalia chebula, No. 3967, Monghyr.

T. tomentosa, No. 3978 *Chuncoa tomentosa,* Monghyr 23 June 1811 and Rajmahal Aug. 1820.

T. arjuna, No. 3979 *Chuncoa glabra,* Monghyr 4 June 1811.

FAM. 63. MYRTACEÆ.

Eugenia jambolana, No. 3560 *Sisygium jambolanum*, Monghyr 3 May 1811.

FAM. 65. MELASTOMACEÆ.

Osbeckia chinensis, No. 4067 *O. angustifolia*, Nathpur 21 Sept. 1810, fl.
O. rostrata, No. 4057 *O. tenuifolia*, Ramjunga 22 Nov. 1808.

FAM. 66. LYTHRACEÆ.

Lagerstrœmia flos-reginæ, No. 2114 *L. reginæ*, Patna. Probably cultivated.
L. parviflora, No. 2119, Rajmahal 7 Aug. 1820, fr.
Ammannia baccifera, No. 2098 *A. vesicatoria*, Monghyr 5 Oct. 1811 and *A. prostrata*, Patna 27 March 1812.

FAM. 67. ONAGRACEÆ.

Jussiæa repens, No. 6331, Patna 24 April 1812, fl., fr.
J. suffruticosa (*J. erecta* var. *exaltata* of Ridley ?), No. 6333 *J. ventilignum*, Monghyr 13 Oct. 1811.

FAM. 71. CUCURBITACEÆ.

Trichosanthes cucumerina, No. 6691 *T. pilosa*, Monghyr 14 Aug. 1811.
Bryonopsis laciniosa, No. 6699 *Bryonia laciniosa*, Monghyr 28 Aug. 1811.
Cucumis melo, No. 6738, Monghyr and Nathpur, 29 May 1811 and 4 July 1810.
Momordica charantia, No. 6745 *M. muricata*, Kaliganj 26 Feb. 1809, Patna 16 April 1812 and Patna 1 May 1812.
Luffa ægyptiaca, No. 6751 *L. pentandra*, Monghyr.
Ditto (*Luffa cylindrica*, *Roem* cited in *Cogniaux Monograph*), No. 6757 *L. satpatia*, Nathpur 27 Aug. 1810, and *L. parvula*, Puraniya 8 Feb. 1810.

FAM. 74. UMBELLIFERÆ.

Carum Roxburghianum, No. 571 *Apium involucratum*, Kisorganj.
Œnanthe stolonifera, No. 585, Nathpur 25 April 1810.

FAM. 77. RUBIACEÆ.

Anthocephalus cadamba, No. 6088 *Nauclea cadamba*, Patna.
Mitragyna parvifolia, No. 6093, Monghyr.
Morinda tinctoria, No. 8421 *M. coreia*, Nathpur 28 May 1810 and Monghyr 20 May 1811.
Ixora coccinea, No. 6120 *I. bondhuca*, Nathpur 17 July 1810. Cultivated.
Ixora undulata, No. 6129, Monghyr 10 May 1811, fl.
Pavetta indica var. **tomentosa,** No. 6173 *P. tomentosa*, Monghyr.
Dentella repens, No. 6206, Patna 4 May 1812 and Monghyr 7 July 1811.

Oldenlandia gracilis, No. 843 *Hedyotis gracilis*, Bhimnagar 12 March 1810.
O. paniculata, No. 875 *Hedyotis racemosa*, Monghyr 24 June 1811.
O. crystallina, No. 6200 *Hedyotis pumila*, Monghyr 9 Oct. 1811.
O. brachiata, No. 6203 *Hedyotis angustifolia*, Patna 3 Sept. 1812.
Spermacoce stricta, No. 822 *S. torta*, Monghyr 24 Aug. 1811, fl.

FAM. 78. COMPOSITÆ.

Vernonia divergens, No. 3032 *V. aspera*, Rajmahal Hills 10 Jan. 1811.
Erigeron asteroides, No. 3052, Monghyr 24 April 1811.
Grangea maderaspatana, No. 3235, Patna 12 March 1812.
Blumea glomerata, No. 3076 *Conyza purpurea*, Rajmahal Hills 7 Jany. 1810.
B. laciniata, No. 3085 *Conyza sonchifolia*, Patna 5 April 1812.
B. virens var. **muralis**, No. 3078 *Conyza muralis*, Paingti 15 Jan. 1811.
Sphæranthus indicus, No. 3178 *S. hirtus*, Patna 12 March 1812.
Anaphalis araneosa, No. 2939 *Gnaphalium decurrens*, Nathpur 27 June 1810. *Vide* p. 1255.
Gnaphalium luteo-album, No. 2953, Arval 13 Feb. 1812.
G. indicum, No. 2954, Patna 3 April 1812 and Bangsi 12 Jan. 1812.
G. pulvinatum, No. 2955 *G. prostratum*, Patna 25 March 1812.
Vicoa vestita, No. 2962 *Inula vestita*, Patna 22 March 1812.
Pulicaria foliolosa, No. 3281 *Conyza foliolosa*, Patna 22 March 1812.
P. crispa, No. 2963 *Inula quadrifida*, Bar 27 Oct. 1811.
Xanthium strumarium, No. 3181 *X. orientale*, Patna 22 March 1812.
Blainvillea latifolia, No. 3204 *Verbesina dichotoma*, Monghyr 29 Aug. 1811.
Spilanthes acmella, No. 3185, Patna 5 May 1812.
Bidens decomposita, No. 3189, Monghyr 30 Sept. 1811.
Tricholepis stictophyllum, No. 2915 *Cnicus angustifolius*, Sukanagar 22 April 1810.
Cichorium intybus, No. 3241 *C. casnia*, Patna 18 March 1812. Cultivated.
Crepis acaulis, No. 3264 *Prenanthes glabra*, Kaligunj 26 Feb. 1809.
Lactuca Heyneana, No. 3258 *Hieracium schimda*, Patna 25 March 1812. *Vide* p. 1255.
Sonchus oleraceus, No. 3252, Patna 12 March 1812 and Kumarganj 22 Feb. 1811.

FAM. 80. CAMPANULACEÆ.

Lobelia trigona, No. 1309 *L. zeylanica*, Nathpur 23 Sept. 1810.

FAM. 83. MYRSINACEÆ.

Embelia robusta, No. 2301 *E. canescens*, Patna and Gongachara. The Patna specimen not found.

FAM. 84. SAPOTACEÆ.

Mimusops hexandra, No. 4148, Monghyr Aug. 1820, leaf only.

FAM. 85. EBENACEÆ.

Diospyros montana, No. 4115 and **D. cordifolia,** No. 4116, not found.
D. embryopteris, No. 4123, Patna 1 April 1812.
D. tomentosa, No. 4133 *D. exsculptus*, Sambalpur 17 Nov. 1810 and Monghyr 3 May 1811.

FAM. 87. OLEACEÆ.

Jasminum pubescens, No. 2852 *J. hirsutum*, Monghyr 14 June 1811.
Ditto, No. 2874 *J. congestum*, Patna 16 April 1812.
J. arborescens, No. 2856, Monghyr 1 April 1811.
Ditto, No. 2877 *J. punctatum*, Patna 16 April 1812.
J. sambac, No. 2869 *J. quadrifolium*, Patna 1 May 1812, also No. 2879 *J. quinqueflorum*, Patna June 1812. No doubt cultivated.
Ditto, No. 2880 *J. pubescens*, Monghyr 11 June 1811. Probably cultivated.
J. humile, No. 2887 *J. revolutum*, Patna 6 May 1812. Doubtless cultivated.

FAM. 89. APOCYNACEÆ.

Carissa paucinervia var. **gangetica,** No. 1678 *C. diffusa*, Monghyr 1 April 1811.
Vinca pusila, No. 1638 *V. parviflora*, Monghyr 9 Aug. 1811.
Holarrhena antidysenterica, No. 1673 *Echites pubescens*, Monghyr 27 April 1811.
Ditto, No. 1672, Rajmahal Aug. 1820.
Wrightia tomentosa, No. 1615 *Nerium coraia*, Monghyr 12 April and 18 April 1811.
W. tinctoria, No. 4461 *W. Hamiltoniana*, Gaya 7 Dec. 1811. No doubt wild.
Aganosma caryophyllata, No. 1651 *Echites caryophyllata*, Monghyr 20 July 1811 and 15 Aug. 1820 (Risikund).
Ichnocarpus frutescens, No. 1674, Bhagalpur 4 Nov. 1810.

FAM. 90. ASCLEPIADACEÆ.

Gymnema tingens, No. 8190, Monghyr 28 June 1811.
Telosma pallida, No. 8181 *Pergularia viridis*, Monghyr 16 July 1811.
T. minor, No. 8182 *Pergularia odoratissima*, Patna 20 April 1812. *Vide* p. 1255.

FAM. 91. LOGANIACEÆ.

Mitreola oldenlandioides, No. 4350, Sukanagar 11 Oct. 1810.

FAM. 92. GENTIANACEÆ.

Exacum tetragonum, No. 4356, Nathpur 24 Sept. 1810 and Rajmahal Aug. 1820.
Erythræa Roxburghii, No. 4397 *Chironia centurioides*, Monghyr 13 April 1811.

FAM. 95. BORAGINACEÆ.

Cordia Rothii, No. 895 *C. reticulata*, Monghyr 21 April 1811.
C. myxa, No. 889, Puraniya.
Coldenia procumbens, No. 942, Monghyr 7 July 1811.
Heliotropium indicum, No. 913, Monghyr. Not found.
H. strigosum var. **brevifolia**, No. 914 *H. revolutum*, Monghyr 23 May 1811.
H. ovalifolium, No. 2089, Monghyr 23 May 1811, fl., fr.
H. supinum var. **malabaricum**, No. 7014 *H. malabaricum*, Patna March 1812.
Trichodesma indicum, No. 932, Rajmahal 7 Aug. 1820.

FAM. 96. CONVOLVULACEÆ.

Evolvulus alsinoides, No. 1317, Monghyr Aug. 1820.
Argyreia cymosa, No. 2257 *Convolvulus glomeratus*, Ganges ad Paturghatta, Aug. 1820.
A. cuneata, No. 1366 *Convolvulus cuneatus*, Patna 17 May 1812, Cultivated? *Vide* p. 1256.
Calonyction muricatum, No. 2249 *Convolvulus muricatus*, Monghyr 13 Oct. 1811.
Ipomœa eriocarpa, No. 1399 *Convolvulus patulus*, Bhagalpur 3 Nov. 1810.
I. pes-tigridis, the entire-leaved form, No. 2250 *Convolvulus capitellatus*, Monghyr 5 Oct. 1811.
I. reptans, No. 1422 *Convolvulus palustris*, Patna 16 May 1812.
I. obscura, No. 1383 *Convolvulus trigonus*, Monghyr 27 April 1811 and Bolahat 8 Nov. 1809.
I. hederacea, No. 1373 *Convolvulus hederaceus*, Patna 21 April 1812 and Nathpur 14 Oct. 1810.
Hewittia bicolor, No. 1410 *Convolvulus bicolor*, Manihari.
Convolvulus paniculatus, No. 1396 *C. parviflorus*, Dumraon 26 Nov. 1812.
C. pluricaulis, No. 1316 *Evolvulus ferrugineus*, Bhagalpur 2 Nov. 1810.
Erycibe paniculata, No. 1330, Monghyr Aug. 1820.
Nos. 2251, 2252, 2253 and 1386, which according to the catalogue concern our province, have not been found.

FAM. 97. SOLANACEÆ.

Physalis minima var. **indica**, No. 2634 *P. angulata*, Nathpur 18 Aug. 1810.
Withania somnifera, No. 2635 *Physalis flexuosa*, Monghyr 21 June 1811.
Solanum xanthocarpum, No. 2612 *S. Jacquini*, Monghyr 22 April 1811.
S. verbascifolium, No. 2616, Nathpur 4 July 1810.
S. torvum, No. 2627 *S. siturium*, Nathpur 27 June 1810.
S. melongena, No. 2628 *S. ovigerum*, Patna 6 April 1812.

FAM. 98. SCROPHULARIACEÆ.

Linaria ramosissima, No. 3911 *L. cymbalaria*, Patna 22 March 1812.
Sutera glandulosa, No. 3941 *Buchnera incisa*, Tikari 5 Feb. 1812.

Herpestis moniera, No. 3900 *Capraria bramia,* Patna 1 April 1812.
Mimulus gracilis, No. 3918 *M. striatus,* Rajmahal Aug. 1820.
Dopatrium junceum, No. 3892 *D. lobelioides,* Monghyr 16 Sept. 1811 and Rajmahal Aug. 1820.
Lindenbergia urticæfolia, No. 3923 *Stemodia ruderalis,* Rajmahal 4 Jan. 1810.
Limnophila heterophylla, No. 3905 *Ambulia heterophylla,* Nathpur 16 Aug. 1811.
L. racemosa, No. 3907 *Ambulia fatua,* Kalkapur 13 Dec. 1810.
Vandellia crustacea, No. 3961 *Torenia alba,* Nathpur 23 Sept. 1810.
V. scabra, No. 3945 *Torenia globosa,* Nathpur 23 Sept. 1810.
V. erecta, No. 3947 *Torenia erecta,* Monghyr 29 May 1911.
V. multiflora, No. 3943 *Torenia trichotoma,* Monghyr 30 Sept. 1811.
V. veronicæfolia, No. 3857 *Gratiola oppositifolia,* Nathpur 30 Aug. 1810.
V. verbenæfolia, No. 3858 *Gratiola verbenæfolia* and *G. bancala,* Monghyr Sept. 1811 and Patna 2 Sept. 1812.
Ditto No. 3951 *Torenia angustifolia, Vandellia angustifolia,* Benth., Nathpur 10 Aug. 1810.
Veronica anagallis, No. 406 *V. amplexicaulis,* Behar 9 Jan. 1812.
Centranthera humifusa, No. 3883, Nathpur 12 Sept. 1810.
Striga euphrasioides, No. 3868 *Buchnera euphrasioides,* Nathpur 23 July 1810.
Ditto, No. 3872 *Buchnera bifida* and *B. denticulata,* Nathpur 21 Sept. 1810 and Monghyr 13 Sept. 1811.

FAM. 99. OROBANCHACEÆ.

Orobanche ægyptiaca, No. 3966 *O. indica,* Patna 18 March 1812.

FAM. 100. LENTIBULARIACEÆ.

Utricularia bifida, No. 1498 *U. lutea,* Monghyr 4 June 1811.

FAM. 102. BIGNONIACEÆ.

Stereosperum suaveolens, No. 6507 *Bignonia quadrilocularis,* Nawada 20 Dec. 1811. Leaf only.

FAM. 103. PEDALIACEÆ.

Sesamum indicum, No. 6408, Nathpur and Monghyr.

FAM. 104. ACANTHACEÆ.

Hygrophila polysperma, No. 2483 *Justicia polysperma,* Patna 26 March 1812.
Asteracantha longifolia, No. 2505 *Barleria longifolia,* Monghyr 30 Sept. 1811.
Ruellia prostrata, No. 2384 *R. repens,* Monghyr 14 May 1811.
Dyschoriste depressa, No. 2396 *Ruellia nagchana,* Patna 19 March 1812.
Petalidium barlerioides, No. 2389 *Ruellia barlerioides,* Monghyr 5 April 1811.

Dædalacanthus purpurascens, No. 2492 *Eranthemum purpurascens,* Manihari 18 Feb. 1810 and Monghyr 9 Nov. 1811.
Barleria cristata, No. 2507 *Barleria ciliata,* Patna 19 April 1812.
Ditto var. **dichotoma,** No. 2509 *B. dichotoma,* Nathpur 14 Oct. 1812 and Patna 29 April 1812.
Lepidagathis purpuricaulis, No. 2366 *Ruellia tenuis,* Burhi-simar 8 March 1811.
L. trinervis, No. 2500 *Barleria trinervis,* Saseram 6 Jan. 1813, fr.
Rungia parviflora, No. 2459 *Justicia pectinata,* Monghyr 20 May 1811.
R. repens, No. 2459 *Justicia repens,* Monghyr 26 Sept. 1811 and Rajmahal 1820.
Justicia betonica, No. 2423, Monghyr 30 Sept. 1811.
J. gendarussa, No. 2342, Patna 25 March 1812.
J. peploides, No. 2441 *J. procumbens,* Ganges and Bhagalpur Aug. 1820, and Monghyr 24 June 1811 and Sibganj 21 Nov. 1809.
J. quinqueangularis, No. 2443, Rajmahal 7 Aug. 1820.
J. diffusa, No. 2444, Monghyr 15 Aug. 1820.
Ecbolium Linneanum, No. 2432 *Justicia ecbolium,* Patturghata 1820.
Graptophyllum pictum, No. 2438 *Justicia picta,* Patna 6 May.
Peristrophe bicalyculata, No. 2457 *Justicia bicalyculata,* Patna 16 April 1812.
Dicliptera Roxburgiana, No. 466 *Justicia chinensis,* Manihari 17 Feb. 1810. This is Nees's type.
Andrographis paniculata, No. 2454 *Justicia paniculata,* Sibganj 21 Nov. 1809.
Phlogacanthus thyrsiflorus, No. 2430 *Justicia thyrsiflora,* e sylvis Magadha. But only the specimen from *Hort. Bot. Cal.* is found.
Blepharis boerhaaviæfolia, No. 2513, Dumraon 26 Nov. 1812.
B. molluginifolia, No. 2514, Monghyr 9 Oct. 1811.

FAM. 105. VERBENACEÆ.

Lippia nodiflora, No. 1824 *Verbena nodiflora,* Monghyr 15 May 1811.
Stachytarpheta indica, No. 2656 *Verbena indica,* Monghyr. The Monghyr specimen is not found, but others under the same number are *Stachytarpheta.*
Verbena officinalis, No. 1825, Rajmahal Aug. 1820.
Vitex negundo, No. 1744, Rajmahal 7 Aug. 1820.
V. trifolia, No. 1743, Patna 22 April 1812.
V. peduncularis, No. 1752, *V. morava,* Monghyr 27 April 1811.
Premna scandens, No. 1774, Nathpur 9 June 1812.
No. 1768, said to be *P. barbata,* from Rajmahal is not found.
Clerodendron infortunatum, No. 1799 *C. dentatum* (the leaves are toothed), Rajmahal 1920.
Caryopteris Wallichiana, No. 1812 *Clerodendron gulmasta,* Patna.
Holmskioldia sanguinea, No. 2087 *Hortingia coccinea,* Rajmahal 10 Jan. 1811, and Patna 20 April 1812.

FAM. 106. LABIATÆ.

Ocimum gratissimum, No. 2720, Monghyr 13 Oct. 1811 and Nathpur 27 June 1810.

O. basilicum, No. 2713, Nathpur 10 Sept. 1810 and Patna 21 April 1812.
O. sanctum, No. 2716, Monghyr 19 July 1811, "ram tulsi."
Orthosiphon rubicundus, No. 2721 *Ocimum rigidum*, Nathpur 6 June 1810.
O. pallidus, (also) No. 2721 *Ocimum bantulasia*, Monghyr 6 Sept. 1811.
Acrocephalus capitatus, No. 1563, Monghyr 9 Oct. 1811.
Coleus amboinicus, No. 2730 *C. aromaticus*, Patna 20 April 1812.
Elsholtzia blanda, No. 1550 *Aphanochilus blanda*, Rajmahal 27 Nov.
Mentha sp., No. 1536 *M. pudina*, Nathpur 22 July 1810.
Salvia plebeja, No. 2149 *S. brachiata*, Sæfganj 15 Feb. 1810 and Kumarganj 20 Feb. 1811.
S. coccinea, No. 2150 *S. gandhara* Patna 24 April 1812. An American species.
Meriandra bengalensis, No. 1526 *Salvia stellata*, Patna 26 April 1812. *Vide* p. 1256.
Leonurus sibiricus, No. 2071, Patna 12 March 1812.
Leucas mollissima, No. 2059 *Phlomis sp.*, Rajmahal 7 Aug. 1820.
Ditto, No. 2525 *L. Hamiltoniana*, Monghyr 13 Sept. 1811.
L. procumbens (? the whorls are 6–7-fid), No. 2063 *Phlomis decemdentata*, Bolahat 8 Nov. 1809 and Patgong 25 March 1809.
Leucas cephalotes, No. 2043, Monghyr 24 Aug. 1811 and Patna 3 April 1812.

FAM. 107. NYCTAGINACEÆ.

Boerhaavia repanda, No. 6769, Monghyr 13 Sept. 1811.
B. diffusa, No. 6770, Monghyr 24 April 1811 and Patna 6 May 1812.

FAM. 108. AMARANTACEÆ.

Deeringia baccata, No. 6888 *D. celosioides*, Monghyr 14 June 1811.
Celosia argentea, No. 6916, Nathpur 11 Oct. 1810 and Monghyr.
Ditto, No. 6817 *C. margaritacea*, Monghyr 24 July 1811.
Allmania nodiflora var. **angustifolia,** No. 6890 *Celosia angustifolia*, Nathpur, 27 June 1810.
Amarantus tenuifolius, No. 6893, Patna 23 April 1812.
A. gangeticus, No. 6896, Nathpur, etc., 13 May 1810.
A. blitum var. **oleracea,** No. 6899 *A. oleraceus*, Sibganj 23 Nov. 1809.
A. viridis, No. 6901 *A. polystachyus*, Patna 20 March 1812 and Monghyr 5 May 1811.
A. paniculatus, No. 6903 *A. amardana*, Bhagalpur 2 Nov. 1813. Seeds large white.
Pupalia atropurpurea, No. 6933 *P. berua*, Monghyr 24 Aug. 1811 and *P. scandens*, Sigbanj 19 Nov. 1809.
P. lappacea, No. 6934 *P. berua*, Monghyr 3 Sept. 1811.
Ærua lanata, No. 6909, Monghyr 14 June 1811.
Ærua scandens, No. 6911, 14 June 1811. Leaves short, 1″ ovate.
Achyranthes aspera, No. 6924, Patna 20 March 1812. L. tomentose obovate.
Alternanthera sessilis, No. 6921 *A. triandra*, Monghyr 20 May 1811.

FAM. 109. CHENOPODIACEÆ.

Chenopodium album, No. 6952, Puraniya 8 Feb. 1810. L. large and cut.

Ditto, No. 6955 *C. purpurascens*, Puraniya 9 Feb. 1810.

C. album ? (probably the top of a large plant of *C. album*, with narrowly linear leaves), No. 6957 *C. chandune*, Patna 20 April 1812.

C. murale, No. 6953 *C. gandhium*, Nathpur 13 May 1810. *Vide* p. 1257.

Beta vulgaris, No. 6949 *B. benghalensis*, Patna 12 April 1812.

Spinacia oleracea, No. 6949 *S. tetrandra*, Puraniya 8 Feb. 1810. L. sharply palmately lobed.

Basella rubra, No. 6960 *B. alba* and *B. cordifolia*, Kumarganj, Thakurganj and Patna.

FAM. 111. POLYGONACEÆ.

Polygonum plebejum, No. 1691, *P. aviculare*, Monghyr 8 June 1811.

FAM. 113. ARISTOLOCHIACEÆ.

Aristolochia indica, No. 2704, Nathpur 25 Sept. 1810.

FAM. 115. LAURACÆE.

Litsæa sebifera, No. 2554 *Tetranthera apelata*, Monghyr.

FAM. 119. LORANTHACEÆ.

Loranthus longiflorus, No. 499 *L. bicolor*, Nathpur 18 Sept. 1810.

FAM. 120. SANTALACEÆ.

Santalum album, No. 4034 *S. myrtifolium*, Monghyr 6 Sept. 1811 and Bhagalpur 1 Nov. 1810. Probably cultivated.

FAM. 122. ULMACEÆ.

Trema orientalis, No. 3689 *Celtis orientalis*, Dumka 29 Nov. 1810.

T. politoria, No. 3693, Dumka.

FAM. 125. MORACEÆ.

Morus indica, No. 4647 *M. indica minor*, Patna 1 April 1812.

M. lævigata var. **viridis,** No. 4650 *M. viridis*, Patna 31 March 1812.

Ficus infectoria, No. 4520 *F. tsiela*, Nathpur 30 May 1810.

F. Arnottiana, No. 4485 *F. populifolia*, Monghyr 3 Sept. 1811.

F. bengalensis, No. 4560 *F. varenga*, Nakeswari 18 Feb. 1809.

F. tomentosa, No. 4497 *F. asimuia*, Monghyr Aug. 1820.

F. cunia, No. 4531, Rajmahal 1820.

F. carica, No. 4506, Patna 8 May 1812. Cultivated.

F. palmata, No. 4507 *F. caricoides*, Patna and Gaya. Cultivated.

FAM. 129. ALISMACEÆ.

Alisma oligococcum, No. 4996 *A. apetalus*, Ratanganj 8 Nov. 1810.

Sagittaria guayenensis, No. 4995 *Alisma pubescens*, Nathpur 17 Aug. 1810.

Butomopsis lanceolata, No. 4999 *Butomus lanceolatus*, Nathpur 23 Sept. 1810.

FAM. 130. NAIADACEÆ.

Aponogeton monostachyon, No. 5167, Monghyr 23 Sept. 1811 and Ratanganj 8 Nov. 1810.
Potamogeton pectinatus, No. 5179 *P. marinus*, Patna 23 March 1812.
P. pusillus, No. 5180, Patna 22 March 1812.

FAM. 131. HYDROCHARITACEÆ.

Vallisneria spiralis, No. 5045, Patna 23 March 1812.

FAM. 132. ARACEÆ.

Scindapsus officinalis, No. 4436 *Pothos officinalis*, Monghyr 19 June 1811.

FAM. 138. CYPERACEÆ.

(The determinations are entirely those of *C. B. Clarke* or synonyms of the same.)

Cyperus pumilus var. **punctata,** No. 3312, Monghyr 13 Sept. 1811.
C. pumilus and **C. globosus** var. **stricta,** also No. 3312, Nathpur 12 Sept. 1810.
C. compressus, No. 3314, Nathpur 16 Aug. 1810.
C. sanguinolentus, No. 3319 *C. foveolatus*, Nathpur 12 Sept. 1810.
C. platystylis, No. 3337, Pirganj 10 Jan. 1809.
C. difformis, No. 3363 *C. haspan*, Monghyr 30 Sept. 1811.
C. haspan, No. 3369 *C. graminifolius*, Nathpur 12 July 1810.
C. flavidus, No. 3369 (same number), Monghyr 30 Sept. 1811.
C. cuspidatus, No. 3376, Monghyr 22 Aug. 1811 (var. *angustifolia*) and Nathpur 16 Aug. 1810.
C. aristatus, No. 3376 (same number), Monghyr 13 Sept. 1811.
C. iria, No. 3360 *C. luteus*, Monghyr 13 Oct. 1811, Patna 25 July 1812. and Nathpur 16 Aug. 1810.
C. niveus, No. 3377, Monghyr Aug. 1820.
C. leucocephalus, No. 3445 (mixed with *Kyllinga*), Monghyr 29 July 1811.
C. distans, No. 3366, Monghyr Aug. 1820.
C. eleusinoides, No. 3347, Monghyr prope Risikhund Aug. 1820
C. corymbosus, No. 3351, Monghyr 19 Sept. 1811.
C. pilosus, No. 3336, Nathpur 18 Sept. 1810.
Ditto, No. 3355 *C. barungia*, Nathpur 23 Aug. 1810.
C. exaltatus, No. 3328, Rajmahal Aug. 1820 and Monghyr 13 Sept. 1811.
C. rotundus, No. 3329 *C. carmutha*, Patna 16 July 1812.
Ditto, No. 3353 *C. mothi*, Patna 24 April 1812.
Ditto, No. 3373, Monghyr Aug. 1820. A very robust form (var." 80-flora ").
Ditto, No. 3322, Nathpur 17 Aug. 1810.
Cyperus digitatus, No. 3438 *Mariscus*, Nathpur 12 Aug. 1810.

Pycreus sanguinolentus, No. 3319 *Cyperus foveatus*, Nathpur 12 Sept. 1810.
P. pumilus, No. 3312, Monghyr 13 Sept. and Nathpur 12 Sept. 1810 (part).
P. globosus var. **stricta,** *C.B.C.*, No. 3312 (part), Nathpur 12 Sept. 1810 (part).
Juncellus pygmæus, No. 3325 *Cyperus musarius*, Patna 24 March 1812.
J. inundatus, No. 3359 *Cyperus gonus*, Nathpur 10 Sept. 1810. *Vide* p. 1257.
Kyllinga triceps, No. 3445, Monghyr 4 Aug. 1811.
K. monocephala, No. 3443, Monghyr 4 Aug. 1811.
K. brevifolia, No. 3443 (same number), Nathpur 30 Aug. 1810.
Mariscus tenuifolius, No. 3432, Monghyr Aug. 1820.
M. compactus, No. 3439, Nathpur 10 Sept. 1810.
M. paniceus, No. 3435 *M. sumatrensis*, Monghyr 10 Sept. 1811. *Vide* p. 1257.
Eleocharis fistulosa, No. 3453 *Scirpus spiralis*, Nathpur 23 Aug. 1810.
E. plantaginea, No. 3454, Monghyr 26 Sept. 1811.
Fimbristylis quinquangularis, No. 3499 *Scirpus satbundius*, Monghyr 23 Sept. 1811.
F. monostachya, No. 3491 *Cyperus indicus*, Nathpur 10 July 1810.
F. squarrosa, No. 3479 *Scirpus aristatus*, Patna 12 May 1812.
F. æstivalis, No. 3479, part of same number and date as *F. squarrosa.*
F. æstivalis, No. 3517 *Scirpus saharmotha*, Patna 17 July 1812 (part).
F. dichotoma, No. 3517, same number and date as last.
Ditto, No. 3511 *Scirpus nildurba*, Monghyr 6 June 1811.
F. tenera var. **verrucænux,** No. 3514 *Scirpus surada*, Monghyr 28 Aug. 1811.
Bulbostylis barbata, No. 3497 *Scirpus tristachyeos*, Monghyr 9 Aug. 1811.
F. junciformis, No. 3520 *Scirpus obtusifolius*, Monghyr 22 June 1811.
Scirpus squarrosus, No. 3477 *Scirpus capillaris*, Monghyr 24 Aug., and *S. squarrosus*, Monghyr 16 Sept. 1811.
S. supinus, No. 3461 *S. lateralis*, Nathpur 12 Sept. 1811.
S. mucronatus, No. 3467, Rissikhund 15 Aug.
S. maritimus, No. 3504 and 3505 (apparently from Gorakhpur district ?).
Ditto, var. **affinis,** No. 3463 *S. balua*, Monghyr 6 June 1811.
S. grossus, No. 3470, Nathpur 10 Sept. 1810.
S. erectus, No. 3462 *S. ternatus*, Nathpur 12 Sept. 1810. *Vide* p. 1258.
S. corymbosus, No. 3472 *S. gonda*, Patna 17 July 1812. *Vide* p. 1258.
Scleria lithosperma, No. 3417, Rajmahal Aug. 1820.
Carex speciosa, No. 3391 *Carex concolor*, Rajmahal 8 Aug. 1820.

FAM. 139. GRAMINEÆ.

Eragrostis viscosa, No. 5008 *Poa tilphulia*, Patna 26 April 1812.
E. interrupta var. **Kœnigii,** No. 3850, Patna 15 May 1812.
E. major, No. 3828 *Poa subsecunda* and *Poa elegans*, Monghyr 14 Aug. 1811, Patna 16 April 1812 and Bhagalpur 4 Nov. 1810.

E. pilosa, No. 3829 *Poa phulia*, Patna 27 April 1812.
Ditto, No. 5012 *Poa phuleia*, Patna 27 April 1812.
E. nigra, No. 3842 *Poa amabilis*, Nathpur 23 Aug. 1810. *Vide* p. 1258.
E. brachyphylla, No. 3827 *E. bifaria*, Monghyr 4 Aug. 1811.
Elytophorus articulatus, No. 3825, Banka 15 Nov. 1811.
Cynodon dactylon, No. 3803, Monghyr 4 Aug. 1820.
Eleusine indica, No. 3816, Rajmahal Aug. 1820 and Monghyr 6 June 1811.
E. ægyptiaca, No. 3818 *Cynosurus cavara*, Patna 16 May 1812 and Monghyr 28 Aug. 1811.
Leptochloa filiformis, No. 3804 *Aira filiformis*, Sibganj 21 Nov. 1809.
Ditto, No. 3805 *Festuca tenuis*, Monghyr 26 Sept. 1811 and Patna 24 April 1812.
Sporobolus coromandelianus, No. 3764 *Milium rurea*, Patna 25 July 1812.
S. tremulus, No. 3770 *Agrostis phuldubba*, Patna 26 July 1812.
S. Wallichii, No. 3769, Rajmahal 7 Aug. 1820. Catalogue also says Monghyr, but this is not found.
Aristida adscenscionis, No. 3786 *A. depressa*, Monghyr 19 Sept. 1811.
A. funiculata, No. 3787, *A. setacea*, Monghyr.

FAM. 140. ERIOCAULACEÆ.

Eriocaulon truncatum, No. 6076, Monghyr 28 June 1811.

FAM. 143. COMMELINACEÆ.

Aneilema vaginatum, No. 5209 *Aneilema filiformis*, Nathpur 30 Aug. 1810.
A. nudiflorum, No. 5260 *A. diandra*, Nathpur ? (tickets conflicting).

FAM. 145. LILIACEÆ.

Smilax prolifera, No. 5124 (part), Puraniya 2 Feb. 1810.
S. macrophylla, No. 5124, Rajmahal 7 Aug. 1820.
Asparagus racemosus, No. 5154 *A. volubilis*, Monghyr 9 Aug. 1811 and Rajmahal 7 Aug. 1820.
Urginea indica, No. 5062 *Scilla candria*, Monghyr 10 May 1811.
Chlorophytum arundinaceum, No. 5056 *Phalangium alatum*, Monghyr Aug. 1820.

FAM. 148. PONTEDERIACEÆ.

Monocharia vaginalis, No. 5095 *P. racemosa*, Nathpur 23 Aug. 1810 and *P. alba*, Monghyr 5 Oct. 1811.
Ditto, No. 5096 *Pontederia vaginalis*, Nathpur 10 Aug. 1810. This is var. *plantaginea* with few-fld. lax spikes.

FAM. 152. DIOSCOREACEÆ.

Dioscorea pentaphylla, No. 5098, Monghyr 30 Sept. 1811.
Dioscorea spinosa, No. 5103 *D. aculeata,* Nathpur 21 Sept. 1810 (also Monghyr according to catalogue, but the specimen not found). *Vide* p. 1259.
D. bulbifera, No. 5106 *D. versicolor,* Monghyr.
D. alata, No. 5107 *D. japonica,* Monghyr 19 Sept. 1811 and Nathpur 14 Oct. 1812.

FAM. 156. ZINGIBERACEÆ.

Zingiber rubens ?, No. 6566 *Z. ligulatum,* Nathpur 22 July 1810.
Z. capitatum, No. 6560, Rajmahal Aug. 1820.

FAM. 159. ORCHIDACEÆ.

Habenaria plantaginea, No. 7053 *Gymnadenia plantaginea,* Monghyr 10 Sept. 1811.
H. longifolia, No. 7060 *Gymnadenia longifolia,* Nathpur 10 Sept. 1810.

APPENDIX II.

ADDITAMENTA.

FAM. 19. AIZOACEÆ (p. 49).

2. TRIANTHEMA, *L.*

Flowers solitary. Style 1. L. usually obovate	1.	*monogyna.*
Flowers clustered. Styles 2. L. not obovate	2.	*pentandra.*

2. **T. pentandra,** *L.* Syn. T. gobvindia, *Ham.*

A herb diffusely branched from the roots. Leaves elliptic or oblong-lanceolate ·5–1·5″, rounded or obtuse, papillose; petiole ·2–·3″, dilated at the base. Flowers in axillary sessile clusters. Stamens 5. Capsule ·1″ oblong mitriform above and 2-valvular, circumsciss at base below the valves, each valve with a 2-lobed divergent beak. Seeds 2 dull-black closely lineolate-channelled, one at the base of each cell, the apex also closely adnate to a seed in each beak.

Monghyr, *Ham.*! Fl., Fr. May–June.

FAM. 39. BURSERACEÆ (p. 172).

4. COMMIPHORA.

Unarmed. L. 3–7-foliolate, lflts. entire. Disc with short free margin	1.	*caudata.*
Armed. L. 3–1-foliolate, lflts. finely serrulate. Disc erect cupular	2.	*Roxburghii.*

2. **C. Roxburghii,** *Engl.*, var. serratifolia, *Haines.* Syn. Balsamodendron Roxburghii, *Arn.*; Amyris commiphora, *Roxb.*; Amyris serratifolia, *Rottler MS.*

A small tree with almost white outer bark peeling off in very thin flakes and disclosing a green under-surface. Branchlets mostly ending in thorns. Leaves 1-foliolate (in our specimen), sometimes 3-foliolate with the lateral leaflets much smaller than terminal and in our specimens mostly visible as two stipel-like or glandular processes. Terminal (or only leaflet) lanceolar-elliptic acuminate, finely serrate, 1–2″ long, petioles slender. Flowers (according to *Roxburgh*) small red, sub-sessile on small axillary tubercles on the leafless twigs. Drupe about ·25″ diam. red.

Collected from a mound on the banks of the Ganges at Mayagunj, Bhagalpur, where several were growing together, *D. Mookharjee*! Fl. h.s.

Specimens were received through the kindness of the Director of Agriculture (*Mr. Dobbs*) and *Mr. Mookharjee*, but the flowers have dropped off and only a few bear leaves. The plant was identified at the Calcutta herbarium as *Balsamodendron Roxburghii*, and agrees well with the equally poor material of this species at Kew.

As regards the name, *Commiphora Roxburghii Engl.* is the *correct* name of *Commiphora Mukul* (*Balsamodendron Roxburghii, Stocks*, 1847, *Balsamodendron mukul, Hook. f.*, 1849. See also *Engler* in *Nat. Pflanz. Fam.*, III, iv, p. 253). But if regarded as a distinct species, this leaves *Balsamodendron Roxburghii* of the *F.B.I.* without a published specific name except the tautonym *Commiphora commiphora*. Rather than rename the plant on the very scanty material that exists of it, and with regard to the view expressed in the *F.B.I.* that it may be identical with *Balsamodendron mukul*, I have treated it as a variety of that species.

FAM. 49. SAPINDACEÆ (p. 215).

7. SAPINDUS, *L.*

Fls. large. Sepals ovate tomentose, disc hairy. Fruit more or less hairy or glabrescent . . . . . Spp. 1 and 2
Fls. small. Sepals orbicular glabrous and petaloid. Disc glabrous. Frt. glabrous . . . . . (p. 215). 3. *Mukorossi.*

3. S. Mukorossi, *Gærtn.* Ritha, *H., Beng.*

A handsome tree with young shoots tomentose. Leaves crowded towards the ends of the branches 6–18″ long, leaflets 10–16 lanceolate acuminate or obtuse, 2–6″ by ·75–2″, glabrous. Fls. ·1″ white or purple in terminal and lateral pyramidal panicles which are tomentose only when young. Petals 5, with a woolly scale on each side at the top of the claw. Ovary 3-quetrous, glabrous.

Cultivated at several places in Bhagalpur and in the Dharbhanga Raj gardens, *D. Mookharjee*. Occasionally cultivated in Chota Nagpur! Fl. May–June. Fr. Sept.–Dec. Renews leaves in April. Native of China and Japan.

Leaflets with numerous close secondary nerves. Sep. and petals ciliate. St. 8, rarely 6. Fruit of usually only one sub-globose smooth yellow drupel ·75–1″ diam.

The fruit is used for soap.

FAM. 78. COMPOSITÆ (p. 475).

Add to key on p. 454:—

Herm. fls. mostly fertile with divided styles . . . . 15. *Gnaphalium.*
Herm. fls. all sterile, their styles obtuse subcapitate or slightly 2-cleft . . . . . 15*. *Anaphalis.*

Add after *Gnaphalium*:—

15*. ANAPHALIS, *DC.*

Erect cottony or woolly herbs with alternate simple leaves. Heads small corymbose, disciform, heterogamous or sometimes unisexual. If heterogamous female flowers outermost, numerous filiform 2–4-toothed. Herm. fls. usually sterile, tubular with subcampanulate 5-fid limb. Involucral bracts scarious, inner with a petaloid limb, outer shorter, outermost woolly. Receptacle naked. Anther bases sagittate with connate caudate auricles. Style of herm. fl. filiform, obtuse, subcapitate or 2-cleft. Achenes very small, oblong, pappus

hairs of fem. 1-seriate, slender, scabrid, free and caducous, of herm. fl. often thickened at the tips.

1. **A. araneosa,** *DC.* Syn. Gnaphalium decurrens, *Wall. Cat.* 2939.

Erect 2 ft. high, cottony with decurrent linear leaves 2–3″ long, white woolly beneath and a terminal close capitate panicle of white heads.

Bhagalpur (Nathpur), *Ham.*! Fl. June–July.
This may be from over the Nepalese frontier (see p. 1233), as it is normally a hill plant. *Clarke* does not quote this specimen in his *Compositæ Indicæ.*

51. LACTUCA, *L.* (p. 496).

A. Flowering stems corymbosely or paniculately branched :—
Peduncles ebracteate. Outer invol. bracts distinct, much smaller than the inner . . . . . 1. *polycephala.*
Peduncles bracteate. Outer invol. bracts gradually passing into the inner. Cultivated only . . . . . 2. *scariola.*
B. Flowering stems slender spiciform or sub-racemiform with heads solitary or fascicled on the rhachis . . . 3. *Heyneana.*

3. **L. Heyneana,** *DC.*

A tall glabrous annual or biennial with stem hollow below and leaves mostly radical 6–12″ very irregularly runcinate-pinnatifid ; cauline few, half-amplexicaul auricled. Inflorescence as in *Launea* with heads in distant spiked or racemose fascicles on the slender branches. Fruit ·1″ long, oblanceolar suddenly contracted to a short beak, black, muricate ; pappus silvery persistent ·2″ long, flexuous, silvery.

Patna, *Ham.*! Fl., Fr. h.s.
Leaves membranous narrowed at the base, with fine spinulose firmer teeth. Heads ·5″, rarely shortly peduncled, bracteolate. Inner invol. bracts in fruit with thickened ribs.

FAM. 90. ASCLEPIADACEÆ (p. 557).

16. TELOSMA, *Coville.*

Pollinia elongate. Cor.-lobes ·3–·5″. L. glabrous or pubescent on the nerves beneath . . . . . 1. *pallida.*
Pollinia globosely obovoid. Cor.-lobes ·2″. L. and petioles hairy . 2. *minor.*

2. **T. minor,** *Craib.* Syn. Pergularia minor, *Andr.* ; Pergularia odoratissima, *Wight.*

A twiner with ovate-oblong, orbicular or ovate deeply cordate suddenly acuminate leaves, 2·5–3″ long, shortly hairy, and with hairy petioles 1–1·5″ long. Flowers ·5″ long (including the often suberect lobes) in umbellate cymes 1·3–2″ diam. "very fragrant," yellow or green. Sepals linear-oblong hairy ·3″ about equalling the corolla tube. Corolla-lobes mostly erect ·2–·25″, oblong ; tube pubescent above within ; coronal scales double, inner with a long subulate point but very variable (*J.D.H.*). Follicles lanceolate 3″ long by ·75″ diam. Seeds ·3″ long, broadly ovate.

Patna, *Ham.*! (*Wall.* No. 8182). Fl. April–May.

FAM. 96. CONVOLVULACEÆ (pp. 586, 587).

5. ARGYREIA, *Lour.*

Stems twining. Leaves more or less ovate . . . . . Spp. 1–5.
Shrubby, branches sometimes twining. Leaves more or less obovate 6. *cuneata.*

6. **A. cuneata,** *Ker.* Syn. Lettsomia cuneata, *Roxb.*; Convolvulus cuneatus, *Willd.*

Suberect and shrubby 2–5 ft. with twining branches (*fide C. B. Clarke*) or (according to *Roxburgh*) altogether scandent, but it is easily distinguished from all the others by the leaves never being ovate but lanceolate-obovate, obovate or obcuneate and often emarginate or obtuse and mucronate. L. 1·5–3″ or sometimes 4″ long, villous beneath. Peduncles numerous axillary mostly 3-fld., ·25–1·5″ long. Corolla large deep bright purple, tubular funnel-shaped, hairy without. Sepals ·2″, ovate, subobtuse. Corolla 2″ diam. Filaments broad, hairy at the base. Fruit ovoid or oblong nearly dry, the septa evanescent so that it appears 1-celled, yellow-brown, shining. Seeds 1–4.

Patna, *Ham.*! Perhaps cultivated only, as it is native of the Deccan. Fl. h.s.

FAM. 106. LABIATÆ.

Insert in Key after I. B. 2. *b.* i. (p. 727):—

Anther-cells very unequal or solitary on a long connective . 17. *Salvia.*
Anther-cells equal distant, pendulous from a very long connective 17*. *Meriandra.*

17*. MERIANDRA, *Benth.*

Hoary or woolly shrubs with opposite coriaceous crenulate and rugulose leaves. Flowers small in many dense-fld. whorls in terminal or panicled spikes. Calyx ovoid with concave upper lip and 2-fid lower lip, throat naked. Corolla with short tube and equally 4-fid limb, lobes flat, upper entire or 2-fid. Stamens short stout, 2 lower fertile erect with anther-cells separated by the long connective, stipitate, pendulous; upper stamens imperfect. Nutlets obovoid, smooth, brown.

1. **M. bengalensis,** *Benth.* Syn. Salvia bengalensis, *Roxb.*

A shrub with smell of sage with tomentose shoots and lanceolate-oblong leaves, larger 5″ by 1·7″, smaller upwards, appearing almost punctate beneath from the close raised tomentose reticulation, subobtuse. Bracts inconspicuous in fruit and shorter than the whorl. Whorls ·3″ diam. in fl., ·75″ in fruit, close dense in terminal spikes 2–5″ long. Fls. white.

Patna, *Ham.*! Native of Abyssinia.

FAM. 109. CHENOPODIACEÆ (p. 769).

1. CHENOPODIUM, *L.*

L. glaucous or mealy beneath, entire at base, upper entire. Spikes simple . . . . . 1. *album.*
L. bright green beneath, rather shining, sharply and unequally toothed. Spikes with spreading branches. Fls. cymose . . 1*. *murale.*

1*. C. murale, *L.*

Rather fœtid, 6–18″ high, branches decumbent. Leaves rather shining bright green rhombic-ovate or deltoid-ovate acute, base cuneate, upper narrower serrate. Spikes short densely panicled ·5–·75″ long. Sepals slightly keeled almost covering the utricle, narrowly scarious. Seed sharply keeled, horizontal, dotted.

Nathpur, *Ham.*! Fl., Fr. May.

The Nathpur specimen has been identified with *C. murale* by *Hooker* and the description is of true *C. murale*, in which the flowers are said to be in lax or dense axillary divaricate cymes, but those of the Nathpur specimen do not appear to be more cymose than in *C. album*.

FAM. 138. CYPERACEÆ.

3. JUNCELLUS, *Griseb.* (p. 906).

Spkts. in a single dense compound head . . . . . 1. *pygmæus.*
Spkts. in loose spikes in a compound umbel . . . . 2. *inundatus.*

2. J. inundatus, *C. B. Clarke.*

Rather stout 1–3 ft. high with the stem 3-quetrous at the top. Leaves often as long as the stem ·25–·3″ broad. Bracts 3–5 foliaceous, 8–18″ long. Umbel compound, rays 3–6, very unequal. Spikelets in open spikes 1–2″ long. Glumes broad-ovate obtuse, 5–7-nerved. Nut over half as long as the glume.

Nathpur, *Ham.*! Fl. Sept.

5. MARISCUS, *Vahl.*

Insert in Key (p. 908) :—

Stolons slender :—
Spkts. small 1-fld., broad-lanceolate recurved and 3-gonous in fruit . . . . . 1*. *paniceus.*
Spkts. 2-fld., narrow-lanceolate and suberect in fruit . . 2. *tenuifolius.*

1*. M. paniceus, *Vahl.*, var. Roxburghiana, *Clarke* (in *F. B. I.*). Syn. Cyperus umbellatus var. panicea, *Clarke* (in *Journ. Linn. Soc.* xx).

A slender glabrous sedge up to 2 ft. high with long slender stolons clothed with lanceolate striate rich brown scales. Leaves often as long as stem. Umbel simple, bracts 5–7, leaf-like. Rays of umbel up to 2″ unequal. Spikes solitary cylindric dense ebracteate. Spkts. ·2″ long, 1-fld. ; 2 lowest glumes empty, persistent, 3rd glume nut-bearing, ovate, deciduous, its upper margins broad scarious, 4th rudimentary. Fruiting spkt. broad-lanceolate, 3-gonous more or less recurved. Nut oblong trigonous, black, two-thirds length of glume.

Monghyr, *Ham.* Fl., Fr. Sept.–Oct.
The description is after *Clarke*.

10. SCIRPUS, *L.*

Add to Key (p. 924) :—

In the bracket opposite I. and after *supinus*, ", clusters on rays of a lateral umbel in *corymbosus*."

After I. A. 2. :—

Spkts. angular, gls. carinate . . . . . 3. *supinus.*
Spkts. terete, gls. convex . . . . . 3*. *erectus.*

In place of B. i. :—

1. Bristles 0. Stem terete:—
Stems septate when dry. Clusters simple near base. Spkts. ·3–·5″ . . . . . 4. *articulatus.*
Stems not septate. Clusters on rays of a lateral umbel. Spkts. ·25–·3″ . . . . . 4*. *corymbosus.*

3*. **S. erectus,** *Poir.* Syn. S. debilis, *Pursh.*

A sedge 6–12″ high or more with terete stems and generally resembling *S. supinus.* Spikelets in a single lateral head, terete. Glumes ovate concave incurved, bristles 5–6, rarely 0, style 2–3-fid. Nut broadly obovoid plano-convex obtuse, slightly transversely wavy, black.

Nathpur, *Ham.*! Fl. Sept.

4*. **S. corymbosus,** *Heyne.*

A stout sedge with a horizontal rhizome and terete leafless stems 3 ft. high and ·25″ diam. at the base. Spikelets ·25–·3″ long, rusty, clustered on the rays of a lateral simple or compound umbel, glumes ovate acute mucronate, glabrous, faintly striate, bristles 0.

Patna, *Ham.*! Fl. July–Aug.
Rays of umbel short or sometimes attaining 5″. Lowest bract ·5–4″ suberect, scarcely looking like a continuation of the stem as in preceding species. Nut obovoid 3-gonous scarcely half as long as glume, black, smooth or with faint transverse lines.

FAM. 139. GRAMINEÆ.

10. ERAGROSTIS, *Beauv.*

Add to Key (p. 955):—

Annual. Spkts. 5–12-fld. Empty gls. unequal, 1 very minute hyaline nerveless. Grain ellipsoid . . . . . 13. *pilosa.*
Perennial. Spkts. 3–9-fld. Empty gls. subequal acuminate strongly 1-nerved. Grain truncate both ends . . . . 13*. *nigra.*

13*. **E. nigra,** *Nees.*

An erect stout or slender perennial 6″–3 ft. high. Leaves with mouth of sheath bearded. Panicle large open lax-fld., oblong to ovate, rhachis glabrous at the nodes, branches many in whorls or fascicles. Spikelets olive-grey ·15–·17″ long, linear to oblong 3–9-fld. Gls. i and ii subequal membranous acuminate strongly 1-nerved with keel scabrid, flg. gls. ovate acute about ·06″ long, palea obtuse denticulate persistent. Grain very short truncate each end.

Nathpur, *Ham.*! Fl. Aug.

FAM. 152. DIOSCOREACEÆ.

1. DIOSCOREA, *L.* (p. 1115).

The following species could be placed first in the Key as it differs from all the rest in the straight sharp spines on the roots and base of stem. It is probably only cultivated in our area. The description is mainly from the *F.B.I.*

1*. **D. spinosa,** *Roxb.* (*F.B.I.*, vi, p. 90). Syn. D. aculeata, *Roxb.*†

Tubers very large. Base of stem with long woody rigid fibres bearing straight sharp spines up to ·7″ long. Leaves simple, orbicular deeply cordate, attaining 8″ diam., acuminate or cuspidate, with 5–7 basal nerves, glabrous or tomentose and somewhat resembling those of *anguina*. M. fls. ·12″ diam. often in very dense cymules, sessile or shortly pedicelled in long simple or nearly simple axillary spikes 6–18″ long. Bracteoles very broad. Stamens 6, anthers large, pistillode large oblong. Fem. raceme rather short, sepals broadly oblong or orbicular. Capsule 1″ diam. broadly obcordate.

Nathpur, *Ham.*! Monghyr, *Ham.* Probably cultivated.

† *Burkill* in the *Straits Settlements Gardens Bulletin*, iii, 15 April, 1924, states that the proper name for this species is *D. esculenta* and that *Roxburgh's D. fasciculata* is also this species.

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